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ON THE EFFECTS OF ARTS, TRADES, AND PROFESSIONS, AS WELL AS HABITS OF LIVING, ON HEALTH AND LONGEVITY.

BY CHARLES A. LEE, M. D. NEW-YORK.

No. IV.

From the statistical calculations contained in a former essay, it appeared that large cities are much more inimical to health than the country; and we remarked that this was owing chiefly to a vitiated atmosphere. Instead of a mortality of 1 in 70, which is about the average ratio in New-England, we have in this city, taking an average of sixteen years, 1 in 36. More than 25 per cent of the whole number die under 1 year, and more than 50 per cent under 20 years. In a paper on the medical statistics of this city, published in the 19th vol. of the American Journal of the Medical Sciences, we thus remarked:—"Out of 23,525 deaths in the city of London in 1829, 9057, or 38.5 per cent, died under 5 years of age, and 28.52 per cent under 2 years. In Paris, during the year 1818, the number of deaths was 22,421, whereof 3942, or 17.58 per cent, were under the age of 1 year, and 24.86 per cent died before the expiration of the 2d. In Philadelphia, during a period of twenty years, the deaths of children under 1 year old were more than a fifth of the whole number; and from birth to 2 years, rather less than one-third, or as 1 to 11 of the whole number. The proportion of deaths

in New-York under that age is somewhat greater. A large proportion of deaths among children, during the warm season, is caused by cholera infantum, or *tabes mesenterica*, which is perhaps but a modification of the same disease. That this is mainly produced by a vitiated atmosphere, is evident from the fact that children rapidly recover from it when removed into the country. It is deeply to be regretted that there are no laws to prevent the undue crowding of population, which is doubtless one of the most influential causes of the disproportionate mortality of large cities. While the construction of our houses is strictly guarded by our municipal authorities, so as to protect them against conflagration, the preservation of life and health, by preventing them from being turned into manufactories of pestilence by too dense a population, seems to be considered as a matter of very little consequence."

It has been generally supposed that *scurvy*, both on land and sea, is produced by improper food, such as an exclusive diet of salt provisions; but it is now pretty well established that it may also be caused by breathing an impure atmosphere, connected with a want of proper and invigorating exercise and neglect of cleanliness. For example: in 1823, the scurvy broke out in an alarming form in the Millbank penitentiary, London, affecting in a greater or less degree all of the 850 convicts then inmates of the establishment, of whom 450 were on the sick list at one time. An investigation was undertaken by order of Parliament, by which it appeared that the chief cause consisted in imperfect ventilation. From the same cause, the pauper children at the Long Island Farms have suffered immensely, and are at this moment generally in a scorbutic state. Owing to this vitiated condition of the solids and fluids, they are extremely exposed to epidemic diseases, by which from time to time large numbers of them have perished.

The late Mr. Eddy, in his account of the state prisons of this state, has also mentioned many instances of scurvy arising from improper food, and particularly, confinement in an impure air.

The manner in which an impure atmosphere occasions this affection is sufficiently obvious. We have mentioned that the digestive organs are the primary and chief seat of derangement

from this cause. The debility under which they labor is soon communicated to the lungs, the brain, the heart, and the skin. The secretions accordingly are imperfectly elaborated, and deficient in quantity; there is a loss of sensorial energy, and a weakened condition of the circulatory or vascular system, occasioning a smaller formation of fibrin, and diminution of carbon from the lungs. The consequence is a looser texture, and deeper hue of the blood, and a soft, relaxed condition of the solids.

The fact is thus abundantly established, that an impure atmosphere is one of the most efficient causes in the production of disease; and it seems no less evident that the digestive and nervous systems feel its influence even more than the lungs themselves. Hence the astonishing number of patients laboring under diseases of the digestive organs, and the numerous deaths by convulsions among young children in cities.* Although the deaths from pulmonary affections are considerably numerous, being about 20 per cent of the whole number, yet it is found that they bear quite as large, if not even a larger proportion, in the country; while those from diseases of the digestive organs are comparatively few. For example: while the deaths from consumption in New-York are only in the ratio of 1 in 9 of the American population, in New-England they are as high as 1 in 6. Thackrah, who has written with great intelligence on this subject, believes that the progress of consumption is much more rapid in the pure air of the country than in the smoky atmosphere of crowded cities.† The same writer estimates that not

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* From January 1st, 1819, to January 1st, 1835, embracing 16 years, there were 5461 deaths from convulsions in this city.

† Dr. Clark, in his able work on consumption, remarks: "Next to improper or deficient diet, I would rank an imperfect supply of pure air, as a cause of tubercular phthisis. The assimilation of the chyle or nutritious element of our food is completed during its circulation through the lungs, and by being brought into contact with the atmospheric air in the process of respiration. It is therefore quite evident that when the respiration is imperfectly performed, from a defective action of the respiratory organs—the consequence of disease, of a sedentary life, or of unnatural position of the body—or from an imperfect supply of pure air, perfect assimilation cannot be effected. In the confined districts of large and populous cities, where neither pure air nor sufficient light can enter, in consequence of the obscure and overshaded sites of the buildings, the food of the inhabitants cannot be assimilated, even though the

10 per cent of the inhabitants of large towns enjoy *full* health. The complexion, he states, is usually pallid, and the tongue shows that digestion is disordered and imperfect. Most individuals have either actual disease of some organ, or an evident disposition to disease.

It is impossible within the limits of our present essay to notice all those classes of operatives, and others who suffer from confinement and insufficient ventilation. Such as have chiefly come under our own observation, besides those already mentioned, are *cotton and woolen manufacturers, tailors, milliners, dressmakers, tailoresses, straw bonnet makers, &c.* most of whom are crowded into small apartments, and employed ten or twelve hours in a day. From the constrained and bent position in which they generally pursue their work, neither respiration, circulation, nor digestion can be well performed, and we consequently find them pale, and suffering more or less from pains in the chest and side, palpitation, indigestion, and nervous symptoms; and very frequently they perish from consumption. Of the large number of girls from 10 to 20 years of age who come to this city from the country to learn the millinery, mantuamaking and tailoring business, but few retain their former degree of health for any length of time. The rooms in which they work, besides being too much crowded and insufficiently ventilated, are in the winter season kept at too high a temperature; the consequence of which is, frequent colds and catarrhs. In a few months they lose their former freshness, and exchange the florid hue of health for a pale and sickly aspect. From constant employment of their eyes in fine sewing, they frequently are

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supply be unexceptionable. A sensible writer on scrofulous diseases considers impure air as their only real cause: other causes may assist; but this he considers essential to their production."

Again: "There can be no doubt that the habitual respiration of the air of confined and gloomy alleys in large towns, as well as that of many manufactories, of work-houses and schools, and of our nurseries and many sitting-rooms, is a powerful means of augmenting the hereditary predisposition to scrofula, and of inducing such a disposition *de novo*. Almost all the children reared in the work-houses of this country, and in similar establishments abroad, become scrofulous—more, I believe, from the impure atmosphere which they breathe and the want of sufficient exercise, than from defective nourishment."

afflicted with opthalmia, which is often serious and obstinate. Indeed, there is no class that suffers more from confinement and insufficient ventilation than the above classes in our large cities. If they would enjoy good health, their hours of labor should be materially reduced, their work and sleeping rooms better ventilated, and they should especially take more exercise in the open air. We might also with propriety mention our retail shop-keepers and drygoods men, who stand behind their counters from morning till night, doing what in other countries is considered women's work; and indeed it would almost seem an act of supererogation to endow man with such noble physical powers, were it his allotted sphere to cut tape or measure silk and calico! This is an employment, it must be acknowledged, for which females are peculiarly well fitted; and there are thousands now out of employment, to whom such an occupation would afford a competent support, and indeed confer absolute happiness. And in making the exchange for other and more active pursuits, those men now engaged in the retail mercantile business would not only find their health and comfort vastly enhanced, but they might reasonably expect to attain to a much more advanced age than they can now rationally hope for.

Although we have stated that the operatives in our cotton and woolen manufactories suffer considerably from confinement and an impure atmosphere, yet the evils connected with these establishments in this country are few compared with those of Great Britain. The "factory systems" of the two countries are indeed on an entirely different plan. In our manufactories the machinery is mostly tended by unmarried females from 14 to 30 years of age, a majority of whom are over 20; and the average time which each one devotes to the employment is about 2 or 2½ years. About 12 hours in the 24 are devoted to labor. A few, perhaps 5 to 8 per cent, find the business inconsistent with their health, and return in a few weeks to their homes. Some find it perfectly safe and agreeable, and remain permanently; but the larger proportion are able to continue but two or three years before symptoms of ill health admonish them to retire. The morals of our manufacturing villages will not suffer by a comparison with those of any other.

In England however it is far different. There the looms and spindles are tended by boys from 7 to 14, who formerly were employed from 13 to 16 hours per day: at present, a period of 8 hours is allowed for all under 13, and one of 12 for those between 13 and 18. Now, in following a pair of mules spinning cotton yarn of No. 40, it is found that a boy takes 4400 stretches daily, or 35,200 yards; making a distance of 20 miles which he walks in the course of 8 hours; while in 1815, in following the same machinery, the distance walked over was only 8 miles—showing, that though the hours of labor may have been diminished by Parliamentary enactment, yet that the spinner's toil has not proportionably diminished.

In 1835, the whole number of persons employed in cotton factories in England was 220,134; four times as many as in 1818. Of this number, 94,287 were between the ages of 7 and 18, and 125,877 above the latter age. Now, it is well known that persons who have already attained their full growth, and particularly those who have reached nearly to the meridian of life, seldom experience the deleterious effect of confinement, under the same circumstances, to such a degree as those in early life.

Dr. Copland remarks, that when the subject was brought before Parliament by Sir Robert Peel, Mr. Owen, of New Lanark stated, respecting the children employed in his manufactory, that although they were extremely well fed, clothed, and lodged, looked fresh, and to a superficial observer seemed healthy by their countenances, yet their limbs were generally deformed, their growth stunted, and they were incapable of making much progress in the first rudiments of education. Sir Astley Cooper, in giving his testimony, also stated, that the result of confinement is not only to stunt the growth, but to produce deformity. The same writer observes, that every traveler in countries the population of which consists chiefly of those whose avocations bring them much in the open air, or in agricultural districts, must have remarked not only the much more fully developed frames and larger lower extremities of the inhabitants of those parts, but also the more phlogistic or inflammatory character of their disorders, and their greater vital

resistance and powers of restoration when exposed to the causes or suffering from attacks of disease, than are manifested by the inhabitants of crowded manufacturing towns.

Dr. Copland truly remarks, that not only is confinement in itself detrimental to the frame, particularly during the epochs of development of the various structures of the body, when air and exercise are nearly as requisite as food to their perfection, but the construction of the apartments, the want of ventilation, the accumulation of animal effluvia, and the moral depravation consequent upon continued assemblages of persons little under physical or moral control, essentially increase its injurious effects, and coöperate with it in impressing an asthenic character on the frame, in disposing to the formation of tubercles and to the strumous diathesis, in depressing the vital energies and mental manifestations, and consequently in disposing the body the more to the usual exciting causes of disease, and the mind to vicious habits and indulgences.

The extremely detrimental tendency of the factory system of England, previous to the Parliamentary investigation in 1819, will appear from the simple statement of a few facts. Many of the children subjected to labor of 16 hours a day, including an hour's intermission for dinner, were no more than 5 or 6 years of age, and from this upwards; and they were compelled to work incessantly as long as the machinery was in motion, during which time they were not allowed to sit down nor leave the factory. They often complained of fatigue and aching limbs; and in this state of exhaustion, towards the close of the day, they were beaten by the spinners or overlookers, or even by their own parents, that blows might supply the deficiency of strength.

In most cotton factories, we are told that during the greater part, and often the whole of the time nominally allotted for dinner, the children were occupied in cleaning the machinery; no time was allowed for the breakfast or afternoon meals, which were snatched in mouthfuls during the progress of uninterrupted labor; the refreshments not unfrequently remaining untouched till they became cold, and covered with dust and dirt from the cotton flyings. It appeared, moreover, that the temperature in

many cotton mills was from 75 to 80°, in others from 80 to 85, and occasionally as high as 90.

The consequences of such a life may be easily imagined. Accordingly, we find it to have been proved before the Committee of Parliament, that the number of operatives above the age of 40 is incredibly small. During a great "turn-out" or *strike* of operatives in 1831, of 1665 persons whose ages ranged from 15 to 60, 1584 were below 45 ; *three* only had attained a period between 55 and 60 ; and not more than 51 between 45 and 50 were counted as fit for work !

Mr. Macnish, a very intelligent witness, stated, that from an actual examination of 1600 men in the factories of Renfrew and Lanark, he found that no more than *ten* had reached 45 years of age, and these were retained by the special indulgence of their masters. Before they arrive at this age, they are too infirm to produce the required quantity. Their eye-sight also fails, and then they are turned off, and younger men employed in their places.

We state these facts, because we conceive that they have a very important bearing upon the subject under consideration, as showing in a very striking light the pernicious influence of confinement and insufficient ventilation upon the healthy development of the physical constitution of man.

It would be appropriate perhaps in conclusion, to offer some additional remarks on the best mode of ventilating public and private buildings ; but as this is a subject belonging peculiarly to the province of the architect and engineer, we shall leave it, with the hope that some of your able correspondents may ere long do it ample justice through the pages of the Repertory.*

New-York, Sept. 10th, 1840.

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* It is remarkable that no adequate means of ventilating the rooms in which our public courts are held in this city have been ever provided, although they are often crowded almost to suffocation. We beg to call the attention of those immediately interested to the following extract from a late number of the London Morning Advertiser :—

"VENTILATION OF THE NEW COURT, OLD BAILEY.—Mr. Perkins has caused capacious subterranean chambers to be formed, in which are placed coils of hot-water pipes, and others containing cold air, which are so arranged, that by turning a valve the warmed fresh air is admitted through apertures made in the floor and wainscoting

For the American Repertory.

LYCEUM OF NATURAL HISTORY.

PROCEEDINGS.

November. Dr. Dekay made some observations on the beaver, and stated that it still exists in the northern part of this state. Mr. Morris exhibited a number of Indian utensils; bones of the beaver, bear and deer, from an Indian fortification at Canajoharie: also, specimens of limestone, quartz crystals from the Mohawk, coal from Flat Creek, and several drawings of rare fossils. Transactions of the American Phil. Soc, vol. vi, part 2d, and the Proceedings of the same, were received from the Society. Prof. Decandolle presented the following works: Mémoire sur la Famille des Anonacées; Combretacées et sur les Genres Connarus et Omphalobrium; Revue de la Famille des Portulacées; Histoire de la Botanique Genevoise. Thanks of the Society were voted to Prof. Decandolle. The London and Edinburgh Phil. Mag. nos. 95 and 96, and Loudon's Mag. Nat. Hist. for Oct. were laid before the Society. Mr. Cozzens exhibited specimens of crys'd galena in carb. of lime, sulp. of strontian, crys'd phosp. of lime, crys'd felspar, from Rossie, N. Y. The Acts of the Berlin Acad. of Nat. Hist. vol. xviii, part 2d, was received from the Academy. Dr. Jay presented a number of fossils from the chalk formation, Eng.

December. Dr. Barrett gave an account of his progress in investigating the willows of this country, and read a paper illustrative of his arrangement. Dr. Jay stated, that while at Nahant, during the month of August, he saw the sea serpent. It remained in sight three-fourths of an hour; the water at the time was perfectly smooth. It was seen at the same time by a

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of the court, so that a comfortable temperature may be preserved, whether the court be more or less crowded. The foul air, which naturally generates in a crowded court, is drawn off by a shaft under the prisoner's dock, as well as from the gallery and ceiling, which, communicating with large curves on the roof, the foul air makes a thorough exit, and fresh air, either warm or cold, can be supplied in such quantities as may be requisite. The above is an important improvement upon the old method of ventilating the courts by canvas bags, and warming them with braziers filled with charcoal."

member of the Boston Nat. History Soc. and two members of this Society. It corresponded in appearance with the account given of it, and with the representation of it in Pontopidan's Hist. of Norway. The distance at which it was seen varied from one-fourth to one-half mile. At the request of the Society, Dr. Jay promised to give a more detailed account at some future meeting. Mr. Cozzens presented a piece of the wood of the juglans regia, from a tree planted on the Battery before the Revolution, and believed to be the oldest exotic on the island: he also exhibited specimens of rensselaerite and deweylite from Mass. The Mag. Nat. Hist. no. 35, and the London and Edinburgh Phil. Mag. no. 97, were received. Willard Parker, M. D. Prof. of Surgery in the University of the State of New-York, was elected resident member, and Lt. Col. Reid, Governor of Bermuda, was elected corresponding member. Dr. Boyd presented specimens of yellow granite, micacious oxide of iron, talcose slate, and red sandstone, from Virginia. Mr. West presented specimens of gibbsite and hematitic iron from Richmond, Mass. Mr. D'Orfeuille, of Cincinnati, presented 32 species of unio, 17 species of helix, 3 species of anadonta, 3 of alasmodonta, succinea obliquata, melania canaliculata, anculosa prœrosus, and planorbis trivolvis. Mr. Blunt presented a jar of nutmegs from East Indies. Thanks of the Society were voted to Messrs. D'Orfeuille and Blunt.

January. Mr. Halsey exhibited a drawing of a fish from the shore of Long Island, which he refers to the genus trichiurus, and considers it as an undescribed species. Mr. Cozzens made some remarks upon the number of lobsters at present taken in the East River: he stated that thirty or forty years ago they were very plenty; about ten years ago they had become very scarce; and within the last three or four years they have gradually increased, and are now taken in large quantities. The Mag. Nat. Hist. no. 36, London and Edinburgh Phil. Mag. no. 98, and the American Journal of Arts and Sciences, no. 77, were laid before the Society. The President presented a new mineral, named daguerreolite, from Long Island, near Gowanus Bay, where it occurs in a layer. Dr. Chilton analyzed it, and found it to be composed of sand in a state of minute division.

It has been used to clean copperplates, for which purpose some of it is well adapted. Dr. Torrey, in the name of Mr. Buckley, presented a number of shells from the interior of Alabama. Mr. Cozzens exhibited a number of minerals from Easton, Pa.; also a hornet's nest, which he had subjected to chemical analysis, to ascertain if it contained any animal matter, but could not detect the slightest trace of any. Mr. Russell made some remarks upon the effect of the weather upon a large mass of Lehigh coal stored at Newark, N. J. It was found the centre of the mass had been very much acted upon, and in some places reduced to powder. Dr. J. Draper and Mr. Peter R. Brinkerhoff were elected resident members.

February. Prof. Von Martius, of Munich, presented the conclusion of the 3d vol. of his Nova Genera et species Plantarum of Brazil. Mr. Brownne reported that most of the seeds presented by Dr. Brinckerhoff, and placed with Mr. Hogg, had germinated, and the lupinus mutabilis is now in flower. The 3d and 4th nos. of Audubon's Birds of North America were received. Dr. Boyd presented, "Geological Reconnoisance of the State of Virginia for 1836." Mr. J. J. Mapes presented the American Repertory, vol. i, no. 1. Transaction of the Am. Phil. Soc. vol. vi, part 2d, was received from that Society. Mr. Haldeman presented the 1st nó. of his Monograph of the Lymniades and other fresh water shells of North America. Dr. Jay presented Primatiæ Faunæ et Floræ Maderæ et Pontus Sancti, by R. T. Lowe, Esq.; also, specimens of copper pyrites from Cuba; and in behalf of Mr. Dayton a species of crustacea, taken from the stomach of a cod. Referred to Dr. Dekay for examination and report, and thanks of the Society were voted to Mr. Dayton. Mr. Brownne exhibited a drawing of a new species of Franciscea or Paraguay jasmin, now in bloom at Mr. Hogg's garden.

March. Dr. Dekay reported that the crustacea referred to him belongs to the stomapoda crustacea, and to the old genus squilla. It may be provisionally arranged under the genus gonodactylus of Latreille. In the Report on the Zoölogy of N. York, where it will be described and figured, it will appear under the name of gonodactylus setimanus. Mr. Taber exhib-

ited a case of American gems, and made some remarks upon their nature and value. Many of the gems rival in brilliancy and color those of the Eastern continent. Dr. Jay presented, Monograph of the Family Unioidæ, or Niades of Lamarck; the fresh-water bivalve shells of North America, by T. A. Conrad. The London and Edinburgh Phil. Mag. nos. 99 and 100, and the Mag. of Natural Hist. no. 37, were received. The President exhibited two very large American gems, viz: the emerald-colored and the ruby-colored tourmalines, from the state of Maine. Specimens of these gems were exhibited by Prof. Shepherd, when in London, to the mineralogists of England, who professed to be unacquainted with them, and pronounced them new. They occur in crystals from two to three inches in length, with a perfect termination. The Corresponding Secretary read a communication from Col. Reid, acknowledging the receipt of his diploma of membership, and explanatory of an unpublished plate, which he presented, intending to explain those great storms which not unfrequently pass over the British Isles, and how a fair wind with a falling barometer may become a foul one before the ships which sail from England clear the narrow channels: such an instance occurred on the 6th January, 1839, at Liverpool, with the loss of much American property. The President presented a large crystal of sulp. of strontian, from Strontian Island, Lake Erie. This crystal is the largest known to mineralogists, the weight of it being 5 pounds. Mr. Cozzens presented specimens of earthy asphaltum from Seyres, Switzerland, and radiated quartz from Staten Island. Dr. Codwise presented a print of hieroglyphics, taken from a rock on the banks of the Nile: the impression was produced by first moistening the paper, and then pressing it forcibly against the face of the rock. Dr. Swift, in the name of H. Ruggles, Esq. presented the 2d Ann. Rep. of the Geological Survey of Michigan. Dr. Draper announced that he had succeeded in getting a representation of the Moon's surface by the daguerreotype; but owing to the Moon's motion, the figure was confused in some places. He also stated that he had obtained impressions by artificial light; that it required a much longer time than solar light, from 30 to 45 minutes being necessary. The Mag. Nat.

Hist. no. 39, and the London and Edinburgh Phil. Mag. no. 102, were laid upon the table. Dr. Jay presented a work on conchology, by Shubert and Wagner; a continuation of the large work of Martini Chemnitz. B.

ADVANTAGES OF COMPRESSED PEAT.

BY ALEXANDER S. BYRNE.

No. III.

The preceding paper shows the value of peat in the manufacture of iron; but it may be profitably used for other important purposes.

Fuel.—It is of great value as fuel for furnaces and firing of every description, more especially so when coked and mixed with coal, or coal tar, or resin, pitch, and such like substances. Mr. Charles Williams, managing director to the Dublin Steam Navigation Company, a gentleman of experience and practical information, recommends a mixture of peat coke and resin for steam vessels. From his statement, printed in the Transactions of Civil Engineers, London, it appears that one ton of resin fuel, (i.e. peat coke and resin) thrown in front of a coal fire, is equal to three tons of coal.

For every description of firing, peat coke is invaluable. Its freedom from injurious and unpleasant exhalations, its durability and extreme brilliancy, are among its chief recommendations. What is so cheering as a brilliant fire! Of domestic comforts it is certainly one of the chief. For such purposes peat fires are unequaled. They are beautiful and pleasant, affording an *intense* heat, and a pure white and yellow flame, not surpassed by the finest coal.

Coking.—This is accomplished by means of heat. There are several modes of coking compressed peat: in every instance atmospheric air is excluded, and passages left for the volatile products to escape, as explained under the head *Pyroligneous Acid*. Some employ large brick chambers, with a hole at the top, a door at the side, and gutters at the bottom for the tar to

escape: others form piles of various shapes, and cover them with loam, to screen the burning heap from a too free access of the atmosphere, which would otherwise consume it entirely. In some districts, large coking ovens are preferred; in others, a sort of iron hood; and in others, the use of large iron retorts. In every instance it is important that the process be conducted as uniformly as possible; that the escapes for tar and gaseous products be perfectly free; and that the mass undergoing carbonization be so distributed that the *whole* be acted on at the same time. Charcoal obtained by the action of rapid fire is always inferior to that obtained by slow calcination in pyramidal piles.

For softening steel plates, charcoal from turf moss is equal to the hardest oak; for the production of gunpowder, many varieties are superior to dogwood and alder, and for crayons it is equal to the finest willow. Much, however, depends on the mode in which it is burnt.

Gas.—Peat is very valuable for the production of gas. We have made considerable quantities in England and in Ireland. Prof. Maugham, of the Polytechnic Institution, London, one of the first practical chemists in that city, was induced to examine the subject, in consequence of our experiments in Ireland, and he has announced his opinion that peat may be so employed to considerable advantage. It has been severely and advantageously tested upon a large scale in Dublin, Paris, and Plymouth. Some kinds of peat (top surface) yield three times as much gas as coal; but as a general rule it does not yield more than Wigan or Newcastle coal: it is, however, far superior in brilliancy and power.

There was an objection to this gas, which for a considerable time destroyed all hope of rendering it useful, and severely injured the works erected for its production. In the distillation, an impalpable powder came over with the gas, which washing and re-washing would not remove, and it eventually deposited itself in the pipes and in the holes of the burners, and stopped them up. To remedy this evil, it occurred to us to use oil in the purifiers instead of water, which, we are happy to add, answered to the fullest extent. We have also found that oil

acts as an excellent purifier for every kind of gas, and greatly improves its quality. The expense is trifling, as the oil when boiled becomes clear, and leaves all impurities at the bottom. Gas passed through *boiling* oil is still better. When mixed with coal in equal quantities, and calcined in the same retort, the peat at the bottom and coal on the top, the coke and gaseous products are superior to those obtained from the finest coal. The brilliant appearance of peat gas, and its *intense heat*, has been matter of surprise to those engaged in its production.

Persons unacquainted with the secrets of a gas-work have urged as a reason against the use of peat gas, that it burns away in less time than gas from coal. In answer to this objection we would observe, that it is not true of gas from a pure top-surface peat, but only of the lower beds; and being more brilliant, a less quantity will give as much light: also, that twice as much peat can be distilled in the same space of time; consequently, *twice as much coke can be obtained*, and at the same expense. Coke is considered *the most valuable* product in a gas-work.

Pyroligneous Acid.—When subjected to decomposition by fire, peat gives off condensible acetic vapors; its elements being separated by the action of heat, and reünited in another order, produce compounds which did not exist before. The proportions of these products differ in the same substances, according to the degree of heat applied, and the skill with which the operation has been conducted. The quantity of crude acid produced from turf-moss, and peat collected from the top surface, is very great.

For this purpose, the apparatus used in the manufacture of coal gas or wood vinegar may properly be employed. This consists of large air-tight cylinders, condensers, purifiers, stills, &c. The compressed peat, well crushed and broken, is to be put into retorts, set three or more in a furnace, after the manner of gas retorts, their doors having been closed and luted with clay. Each door has a small vent, capable of being closed by a stopper or valve. The use of this vent is to allow the volatile products which are given off during calcination to escape; and the use of the stopper is to close the vent so soon

as the calcining matter ceases to give out such vapors; or supposing, as is usual, another vent to be in the upper part of the retort, then it allows the operator to watch the process of calcination. Within each retort passes a rod, revolving upon its two extremities as points; the one end resting on the farther extremity of the retort, and the other in a hole in the stopper, capable of being closed by a cap. This rod has at one end a circular plate; and at equal distances along its length are fixed fans or spokes, perpendicular to the axis of the retort. The use of this apparatus is to stir and divide the matter while in calcination; and it does this when the stopper is removed, and a key is inserted into the rod, and turned round, causing of course the rod with its fans to revolve on its axis. The use of the round plate is, when the matter is perfectly calcined and the door is removed, to draw it forward, and rake it out with as little delay as possible into proper recipients placed in front.

The retorts should be heated to a pale cherry red before they are filled; and as soon as they are rendered air-tight by the closing of the doors, the process of decomposition begins, and the volatile products, consisting of gases, vegetable tar, and pyroligneous acid, being separated, pass off through an aperture in the top of the retort, to which pipes are attached, leading into condensers: these pipes are generally *wormed*, and inclosed by a stream of cold water. The gases may be purified, and collected in a gasometer to be burned, or turned off by means of a pipe into the fireplace. The condensed liquors are then allowed to settle: the vegetable tar falls to the bottom, and the crude liquor is separated by decantation from the empyreumatic oil associated with it, and re-distilled in the ordinary way. The odor peculiar to this acid may be easily removed by agitating it with oil, and distilling it with sub-carbonate of potash and animal charcoal: or the vapors which pass over during distillation may be purified with greater effect by passing them through oil.

It is to be observed that the volatile matter which is allowed to escape during calcination is all valuable. The tar is useful as a varnish; or being subjected to distillation by itself, it affords crude pyro-acetic spirit, naphtha, kreosote, &c. The gases may

be employed for illumination; and the crude acid may be employed for preparing acetate of iron, acetate of alumina, and acetate of lime (used in calico printing); or it may be used for the production of pure acetic acid and the best household vinegar. The charcoal which remains in the retort is superior to wood charcoal, and may be used as fuel.

Roads, Pavements, &c.—Peat does not answer alone for these purposes, being of a pulpy nature when wet, and too easily pulverized; but when combined with an artificial asphaltum, composed of carbonate of lime and coal tar, it forms a solid and elastic road, superior in many respects to wood or native asphaltum, and presenting a surface which in all seasons affords good footing for cattle. The tendency of this artificial asphaltum to crack and break is counteracted by the strong fibre of the turf, which, if added to the chalk and tar while warm, acts as a *binder* when the mass is cooled, and obviates its brittleness. In this respect peat is analogous to hair in mortar.

For Cabinet and Ornamental Work, it is only necessary to use the peat when warm. It may then be moulded to any form, and afterwards hardened in alum water, varnished, or covered with metallic solution, to render it impervious to water. When properly compressed, it can be worked in the same manner as wood, and is capable of sustaining a very high polish.

Having said so much on the properties and uses of peat in compressed and other states, we would remark in conclusion, that where density is not a considerable object, peat can be advantageously worked in good brick machines, provided the superabundant water is evaporated, and the operation completed, while the peat is warm.

We sincerely hope that these observations may induce our friends in Ireland to provide suitable employment for the laboring poor of that country, and that her desolate moors may soon become, as was once said of them, "mines above ground."

CAPT. ERICSSON'S STEAM FIRE-ENGINE.

Having in our last number presented to the reader minute plans and descriptions of the steam fire-engine for which the gold medal of the Mechanics' Institute was awarded, we will now perform the interesting task of more fully pointing out the leading features of this important invention. But before doing so, we deem it important to state, that Captain Ericsson has planned the steam fire-engines now in use in Europe, viz. one for London, one for Berlin, (ordered by the king of Prussia) and one for Liverpool docks; all of which have been manufactured at Braithwaite's celebrated engine manufactory, in London. These engines having been constructed on different principles, and frequently tested by practice, it is but reasonable to infer that Capt. E. should be enabled to decide with considerable certainty what form of engine will answer best in practice—a circumstance which of itself entitles his plan to serious consideration.

At first sight, it would appear that the application of steam to fire-engines is a problem easily solved; but that such is not the case becomes apparent at once, on considering that a steam fire-engine must of necessity contain:—

1. A powerful hydraulic apparatus for projecting the water under great pressure.

2. A complete steam-engine of at least 15 horses power, with boiler and various other parts common to all steam-engines.

3. The natural draught produced by a chimney being insufficient, some apparatus becomes indispensable as well for raising the steam quickly at the commencement, and during the transportation of the engine to the place of operation, as during the time the engine is at work.

4. A carriage or frame-work to which the whole of the machinery may be attached, supported on springs, axles and wheels. The weight of all this machinery, as well as the space it occupies, must be kept within very narrow limits, in order to be transported with facility.

These considerations cannot fail to lessen our surprise to find

that the powerful and untiring aid of steam has not long ere this been employed to prevent the destruction of property by fire.

Capt. Ericsson has forwarded to us a description of the three steam fire-engines planned by him in Europe, which we have great pleasure in laying before our readers, as affording much useful information on the subject.

The engine at Berlin has two steam cylinders and two force-pumps,—each pump and steam cylinder directly connected, as shown by the engraving in our last number, but having connecting rods attached to cranks placed at right angles, and fixed on a common shaft. This arrangement, which appears at first sight very perfect, does not however produce regularity of motion; for when the cranks are in the diagonal position, there are *two* pumps in *full* operation, whereas when they are in the vertical and horizontal positions there is only *one* pump acting; now the outlet for the water remains the same; hence, a sudden start or jerk takes place at this moment: on the other hand, that a retardation must take place at the moment of both pumps being in full operation is evident, since they have no power of producing increased compression in the air-vessel, the force of each steam piston being balanced by a corresponding resistance from its respective pump. This irregularity of motion is however not so injurious as to condemn the arrangement, did it not at the same time entail great complication and weight: cylinders, valves, pistons, and a variety of other parts, being doubled in number: besides, there is the entire addition of connecting rods, guides, crank, shaft, bearings, &c. to say nothing of the increased weight of frame-work consequent on the crank movement.

The steam fire-engine constructed for the Liverpool docks consists of two small steam cylinders, acting on cranks, fixed at right angles on a common shaft, carrying a small fly-wheel, and worked at great speed; this shaft giving motion to a "three throw crank," by means of cog-wheels, the diameters of which are in the proportion of 1 to 5; three single acting force-pumps being worked by the said crank. This engine, like the one for Berlin, is very efficient, but expensive, unnecessarily complicated, and heavy, whilst its motion is far from being regular.

The London steam fire-engine, which has frequently been kept at work for a whole day without stopping, and has on all occasions, when put into action at extensive fires, given unqualified satisfaction, is constructed on the principle of the engine which it is the object of this paper to characterize, though differing greatly from it in detail and arrangement.

By referring to the engravings in our last number representing this latter engine, the reader will see that one of its *distinguishing* features is the direct manner by which the steam-engine is connected to the force-pump, dispensing with most of the ordinary parts of a steam-engine, such as crossheads, guides, connecting rods and couplings, cranks, shafts, bearings, fly-wheel, intricate frame-work, &c. &c.

The simplicity and elegance of this arrangement become manifest, on reflecting that the steam in the cylinder is actually made to press directly against the water in the force-pump, by means of a metallic body interposed in the line of the moving force and the fluid to be displaced; the force thus applied suffering no other loss of useful effect than the trifling friction of the two pistons and their rods passing through the stuffing boxes. The compactness, lightness, strength, and lessened liability to accident consequent on this simple form of engine, are sufficiently evident to render any further remarks upon them unnecessary.

The means employed for supplying air to support the combustion in the boiler, will be found another important and distinguishing feature in the construction of this engine.

The most essential part of a steam fire-engine is, from obvious reasons, the means possessed for keeping up a lively combustion in the furnace at all times: *time* being the all-important consideration, a perfect command of steam is indispensable, and that depends entirely on those means. Resort must of course be had to *artificial* draught, which may be produced either by steam blast as used in locomotive engines, by the centrifugal blower, or by bellows or cylinder blast: preference, however, must be given to the latter, on the following considerations:—Steam blast answers well for locomotive engines, which, by having double cylinders, and working at great speed, produce

a quick succession of "puffs" in the chimney, and thereby a tolerably regular draught; but it is badly adapted for a single engine and slow motion, as it causes distinct shocks, which carry a great quantity of ignited fuel through the flues; a circumstance, considering the situations into which a fire-engine will sometimes be brought, that is sufficiently disadvantageous to condemn the arrangement, did it not at the same time, by rendering the fire surface in the boiler nearly inactive during the intervals of the "puffs," entail the necessity of employing one of increased size The total want of command of steam, particularly at starting, is however the great objection to this mode of supporting the combustion, and only to be met by employing some *additional* contrivance.

The objection to the use of the centrifugal blower is not only that it requires a rotary motion, gearwork and straps, but the force of the blast produced thereby will be quite insufficient for a steam fire-engine boiler, although it answers well for boilers which have comparatively large flues and fireplaces. To prove this, we have only to consider that a common blower, moving at the rate of 100 feet per *second* (at the circumference) produces a blast the force of which is not equal to three inches column of water; for, a body falling through a space of 156 feet will attain a velocity of 100 feet per second: now, a column of 156 feet atmospheric air is barely equal to three inches column of water. Any obstruction in the flues, clinker on the fire-bars, &c. will evidently render such trifling pressure inadequate to force a sufficient quantity of air through the boiler, thereby rendering the engine inefficient or useless. Hence, nothing short of bellows, or a piston working in a chamber, will produce the desired effect. By these means only can the requisite quantity of air be supplied; and whether the moving power is derived from the engine, the motion of the carriage, or manual force, every stroke of the blowing piston will cause the consumption of a given quantity of fuel, and the development of a given quantity of heat;—thereby establishing *certainty*, and rendering the whole operation a simple matter of calculation.

For the American Repertory.

DAGUERREOTYPE.

The following extract of a letter from M. Melloni to M. Arago, which we find in the *Annals de Chimie et de Physique*, will be interesting to such of your readers as are engaged in experiments on the Daguerreotype:

"The only parts of my memoir which will be of general interest, are those that relate to the consequences which I have drawn from a long series of observations upon solar heat. In repeating many times, with the same prism of *rock salt*, the analysis of the solar ray, I have established the fact that the maximum of temperature is not always in the same place, in the obscure part of the spectrum beyond the red, but sometimes more and sometimes less distant from the colors, and this in cases perfectly similar in reference to the force of radiation, the serenity of the sky, and the transmission of the air. I have concluded that the calorific rays separated from light reach us in greater or less quantities, according to certain modifications of the atmosphere, which exert no corresponding influence on the transmission of the luminous rays. Now, it appears to me that there is a great analogy between this phenomenon and that observed by M. Daguerre relative to the direct action of the chemical radiation, corresponding to the equal altitudes of the sun above the horizon. In this case, however, it would be the obscure part of the spectrum beyond the violet, which would experience in its passage a greater or less absorption in consequence of some peculiarity in the state of the atmosphere which does not affect its transparency. It is true that in this hypothesis it is necessary to admit that the permeability of the air for the obscure chemical rays is different in certain cases, from its permeability for luminous rays. But have we not in the present day a great number of facts which would lead us to believe that this is really the case in reference to the optical calorific and chemical effects of the same irradiation?" H.

For the American Repertory.

LOCOMOTIVE TOWING ON CANALS.

I am reminded by the account of the interesting experiments on the application of locomotive steam power to canal navigation, given in your last number, that the directors of the Delaware and Raritan Canal have lately applied the same power to tow the large barges and coasting vessels which now pass through their works. The New-Jersey Railroad, which is owned in part by the same Company, passes from Trenton to Kingston, a distance of 11 miles, on the bank of the Canal; and it is along this part that the locomotive is applied. The experiment has been found perfectly successful: six vessels, each of about 150 tons burden, or of about the ordinary size of a Hudson River sloop, are towed at the rate of three miles an hour. A greater velocity might be obtained; but beyond this the large boats become unmanageable, and cease to obey the helm—probably on account of the increasing and irregular resistance of the water between the sides and bottom of the canal and those of the vessel.

Experiments were also made a few years since, by the same Company, on the practicability of lessening the power of traction by increasing the velocity, as in the case of the results on the Scotch canals. But owing to the depth of the water, and the consequent great velocity of the wave, it was found impossible by the use of horse power (which was then alone used) to keep the boat on the top of the wave. H.

[For the American Repertory.]

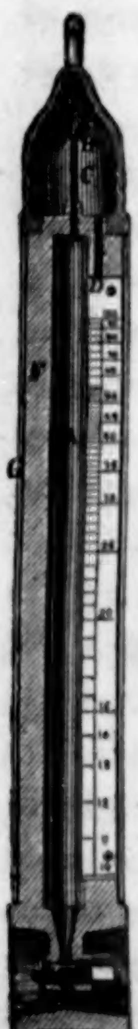
THE RAILROAD A LIGHTNING-CONDUCTOR.

All conducting bodies in the vicinity of a charged conductor become electrified by induction; and the intensity of the induced charge is always some *fraction* of the length of the body and its conducting power. Now, when a charged cloud passes over a long line of railway, a powerful inductive effect must be exerted on the part of the track immediately beneath; and on account

of the great extension of the line of the metal in opposite directions from the cloud, the part of the rail just under must become highly charged; and this state will continue while the cloud retains its position and intensity of inductive action; but if a discharge takes place from the cloud to the earth, or from the cloud to another, then the induced state of electrical equilibrium in the rail will be suddenly disturbed, and sparks will probably be produced at each point where there is a solution of the perfect continuity of the metal, perhaps for miles in extent.

A friend informs me that on one occasion happening to be near a straight line of railway in Pennsylvania, during a thunder storm, he was surprised to see the lightning at each flash coursing, as it were, along the rails apparently, for miles in length. H.

OGDEN & ERICSSON'S PATENT LEAD, OR SOUNDING INSTRUMENT.



This instrument may be considered as an important addition to the valuable discoveries which have been made in modern times to render navigation safe and easy; its principle being such, that it enables the navigator to take soundings, or ascertain the depth of water, whilst the ship is under way, and independently of the measurement of the lead line.

The inconvenience, loss of time, and frequently danger, consequent on rounding a ship to the wind every time a cast of the deep-sea lead becomes necessary, is best understood by the experienced sailor; and he can best judge of the utility of a sounding-instrument, who has seen the safety of a numerous crew and a fine ship depend entirely on the accuracy of the soundings.

The annexed engraving represents a section of the instrument, with its interior arrangement—the construction being as follows:

A is a glass tube open at both ends, firmly bedded in the cast-iron stem *F*, by means of cement. *B* is a small tortuous pipe inserted into the top of the glass

tube, and in continuation with it: this pipe is open at the top, and communicates therefore freely with the air-chamber *C*; and this last with the external air by the small tube, whose orifice is *D*. *E* is a common stop-cock at the bottom of the glass tube; and *G* is a guard to the glass tube. The lower end can be loaded with lead when required, and takes the arming as usual. When the instrument is to be used, the stop-cock *E* is closed, after turning it to let out any water that may have been suffered to remain in the tube; the gaurd is drawn round, and the lead is lowered gently into the sea, with the line attached. The pressure of the water at *D* begins at once to exceed the pressure of the air within the chamber *C* and tube *A*, and the water begins to rise through the small tube *D* into the chamber, driving the air before it into the upper portion of the chamber and tube *A*, until it has risen to the top of the tortuous pipe *B*. At this instant the whole of the air before contained in the chamber and tube is confined to the tube only: the water, therefore, still entering at *D*, falls over the orifice of *B* into the glass tube, and rises in it: the division to which it rises always indicating the depth to which the lead has descended.

The register being the column of water in the tube, it evidently cannot be affected by any shock, nor disturbed, unless the whole be held with the upper end downwards, which the tortuous or corkscrew tube *B* is intended to provide against; and the pressure of the air within being always equal to that of the water without, there is no strain upon any part of the instrument.

As the lead is hauled up again, the air expanding in the tube forces the water gradually out of the chamber. When it is taken on board, being always held nearly upright, though not necessarily quite so, the guard is drawn back, the soundings read off, and the arming examined. The water being then let out by the cock, it is set again, and the instrument is ready for operation. The mode of using the lead is as follows:

The lead being bent to the line, close the guard so far as to leave full an inch opening, to allow the water to enter freely round the glass tube, and turn the brass key so as to bring two crosses together that are upon the instrument; lower the lead

gently, *and when it has nearly reached the water*, drop it, and give out line *very freely* until it touches the bottom. When hauled in, be careful to keep it in an upright position; therefore do not inspect the arming until the depth is read off: the height of the water in the glass tube will indicate the depth in fathoms, as marked on the brass plate. When read off, give *one quarter* of a turn to the key, in order to allow the water to run out, and in that position leave the key, in order to prevent the possibility of any water remaining in the glass tube or in the air-chamber when the instrument is again to be used.

Should dust at any time appear in the glass tube, it may easily be washed out by plunging the instrument a few times into the water with the *cock open*. When the lead is not in use, keep the guard quite closed, to protect the glass tube. Keep the brass plate bright, and apply some paint to the iron work occasionally, to prevent corrosion.

This valuable instrument for navigation is the joint invention of Mr. Ogden, U. S. consul for Liverpool, and Capt. Ericsson. It has stood the test of numerous trials in almost every part of the globe, and a great number of certificates have been transmitted to the inventors. We have selected the first and last of these certificates, which we recommend to the perusal of our readers, in proof of the practical utility of this truly philosophical mode of arriving at a correct knowledge of the depth of water from a ship whilst under way.

Plymouth, 22d Sept. 1836.

To Capt. ERICSSON:

My Lords Commissioners of the Admiralty having ordered a trial of your Patent Sounding Instrument, I was directed by Rear-Admiral the Honorable Sir Charles Paget, on the 12th of this month, to proceed in H. M. brig Partridge, under my command, towards the Atlantic Ocean for that purpose. I have accordingly to certify, that I have put your Sounding Instrument to a complete practical test, by using it every second hour, by day and by night, for nine days, beginning with a depth of 5 and extending to 600 fathoms; soundings up to 80 fathoms being obtained whilst going at the rate of six knots per hour.

Respecting the accuracy of the Instrument, I have only to state that I found it perfect; and as to its simplicity, I need only say that all my crew soon understood its use. And on these grounds I can strongly recommend this Instrument as being of great practical utility.

PHILIP BISSON, *Lt. and Comm.*

Communication received from Capt. Ogden, commander of the U. S. ship Decatur, dated Rio Janeiro, 1st July, 1840:—

On our arrival in the neighborhood of Cape Frio, I laid down the ship's place at 8 o'clock P. M. by chronometer, and found by the chart that we must be on soundings. We were going about seven knots, with studding sails set; therefore I had the instrument passed forward, and required every man along the side to hold a coil in his hand, until the whole line, 150 fathoms, was out. I then saw the lead carefully lowered until it touched the water, and let it run. When we hauled it up we found it had touched bottom in 75 fathoms water, coral and broken shells. We continued to sound with it in the same manner until daylight, when Cape Frio was plain in sight. Com. Ridgeley was much pleased with the performance of the lead, but intimated that I had no proof of the depth given being correct. On our arrival off Rio, we were perfectly becalmed. I took the line accurately marked, and bent it on to the patent lead. I then lowered it over the quarter, and let it run until it touched bottom. The line, up and down, showed 31 fathoms. I ordered the lead hauled up; and on looking at the glass the water stood at exactly 31. All were then convinced, and declared it to be the most perfect thing of the kind ever invented, which is literally the truth. I have shown it to several English officers, who were delighted with it; but they seem never to have heard of it before. I thought, after the satisfactory trial made by the brig Partridge, that it would be generally adopted in the British navy. I found one on board the Columbia, Com. Read, just returning from a cruise in the East Indies. It never failed to give them correct soundings, and was of great use running in the night among shoals and reefs in the Indian Ocean. No commander who has ever used one of them would be willing to be without it.

[For the American Repertory.]

ON THE STEAM-ENGINE.

(CONTINUED.)

In a previous paper we quoted Mr. Palmer as stating the maximum effect that nature is capable of accomplishing to be 44,467,500 lbs. raised one foot high, with one bushel best Newcastle coals, in the absence of all *friction*. And at the same time we stated that a Cornish pumping engine, in London, had performed a duty of 72,000,000 lbs. besides the accompanying *friction*. According to a later report, the same engine has performed 92,000,000 lbs. duty, besides friction—Welsh coals having been used, and the steam cut off at $\frac{1}{3}$ of the stroke; which latter circumstance we wish particularly noticed, as cor-

responding with our experience, and because we shall have to allude to it hereafter. It here appears that the *duty actually performed* by steam is more than double the utmost power that steam possesses, as Mr. Palmer understands and states it. How great then his error becomes, when the *friction* is added to the duty, which in the Cornish engines is frequently much more than the duty itself; and how clearly it appears that he did not know one quarter part so much of the true value of steam as the Cornish engineers whom he so presumptuously undertook to rebuke.

The friction of the Cornish single pumping engine has been treated by Mr. Wickstead as single also; now, although the action of steam, from its being confined to one stroke in these engines, is single, yet the friction extending alike to both strokes of the engine and the pumping machinery also, is double, and the joint amount truly enormous, from the great mass of matter to be moved, of which the timber pump-rods alone, 12 to 14 inches square, extend perpendicularly 700 to 800 feet or more, and in many instances to great distances horizontally. In none of the reports of duty by the Cornish engines are these important contingencies either described or alluded to with the attention they deserve or that is required for a due consideration of the subject, but are all indiscriminately merged into the comprehensive term, "friction;" and this being doubled by the peculiar formation of the engine, is necessarily prodigious as it appears to be in Mr. Henwood's tables, in 2d vol. Journal Inst. Civil Engineers. Hence, the reported "duty" of these engines has been only the inadequate representative of a portion of their *power;* for it must be readily conceded that all power wasted or misapplied is as truly power as that usefully employed; and this latter portion alone has the duty hitherto truly represented.

The annexed table is abstracted from Mr. Henwood's lucid and valuable description of his careful experiments on the best engines in Cornwall. It will be seen that Watt's double condensing engine, an estimate by Professor Renwick of the loss of power of which we condemned in a former paper as extravagant, and justly condemned as we shall hereafter prove, becomes by contrast with these in the table the very mirror of economy.

ABSTRACT FROM HENWOOD'S TABLES.

ENGINES.			HUEL-TOWAN. Cyl. Bottom and Cover Steam Cased.	BINNERDOWNS Cyl.&steampipes heated with fire.	EAST-CRENNIS. Cyl. & Steam Pipes cov. with sawdust.
Diameter of Cylinders.		in.	80	70	76
Diam. of Valves.	Steam.	in.	8	9	10
	Equilibrium.	in.	12	12	14
	Exhausting.	in.	16	16	16
Length of Stroke.	Cylinder.	ft.	10.00	10.00	10.25
	Pump.	ft.	8.00	7.50	7.16
Air Pump	Diameter.	in.	36	33	two of 26
	Stroke.	ft.	4.0	4	4.5
Water in Boilers.		cub. ft.	1080	636	1920
Steam in Boilers.		cub. ft.	700	350	650
Temperature of Hot Well.		deg.	93.8	89.2	88.2
Temp. Condensing Water.		deg.	64.7	52.3	67.0
Area of Fire Grates.		sq. ft.	72.0	48.0	37.5
Surface exposed to action of Flame.		sq. ft.	114	76	57
Total Heating Surface exposed.		sq. ft.	2600	1440	2500
Absolute Steam Pressure in Boilers per sq. inch.		lbs.	61.8	74.78 58.0	36.8 26.3
Times Steam is expanded.			$1\frac{2}{3}$	$\frac{1}{9}$ $1\frac{1}{7}$	$\frac{1}{3}$ $2\frac{2}{5}$
Absol. steam in cyl. pr. sq. in.		lbs.	27	26 25	25 21
Load per inch on area of Piston—Useful Effect.		lbs.	10.2	10.23 10.2	11.4 11.4
Friction—Loss of Power—Useless Effect.		lbs.	16.8	15.7 14.8	13.6 9.6
Duration of Experiment.		hrs	$24\frac{1}{2}$	25	$22\frac{1}{2}$
Coals consumed.			Bu. 50=5000lbs	60=5561	3005 lbs.
Oil used.		Pts.	1	1	1
Grease used.		lbs.	20	$15\frac{1}{2}$	17
No. strokes made by Engine.			7,881	11,258	4,717
Strokes per minute.			5.35	7.49	3.5
Duration of working stroke.		sec.	1.6	1.34	1,7
Duration of return stroke.		sec.	4.8	4.23	4.17
Interval between strokes.		sec.	4.8	2.4	11.2
Tons lifted 1 ft. for 1 farth.			1085	1006	870
Duty in lbs. lifted 1 ft. with 84 lbs. dry coal.			77,533,710	74,395,923	73,502,699

The tables from which the preceding is compiled contain very careful descriptions of important *facts*, to which we have added a column with the nearest vulgar fraction, denoting the quantity of steam expanded, and another column for the "friction," or power wasted or uselessly expended, to show at a glance, without trouble, the actual advantages or disadvantages of using steam of various densities.

Let us now compare these *facts* with a table and statements from Prof. Renwick's Treatise, p. 157;

"*Relative powers of an Engine using the same quantity of Fuel, and acting expansively at different tensions.*

Force in Atmospheres.	In lbs.	Cylinder Filled	Effective Force.
$1\frac{1}{6}$	17.5	wholly	10.00
2	30.0	$\frac{1}{2}$	10.75
3	45.0	$\frac{1}{3}$	27.50
4	60.0	$\frac{1}{4}$	35.60
5	75.0	$\frac{1}{5}$	43.50
6	90.0	$\frac{1}{6}$	51.00

It will therefore appear, without any change in the general distribution and plan of an engine, provided the boiler be strong enough to bear the increased force of the steam, its power may be readily increased five-fold."

Again (p. 158): "This method has been brought to the test of actual experiment, in the pumping engines in the mines in Cornwall, and by its use the power of an engine of a certain nominal horse power has been increased five-fold."

Again (p. 160): "In this way the force of steam has been gradually raised from little more than a single atmosphere to ten; and an intelligent Cornish engineer states he has seen it raised to 20 or to 30 atmospheres."

Now, it is most desirable and essential that this bold theoretic statement should be examined by competent persons, whose examination might confirm it if right, or disprove it if wrong, for the sake of the public weal—for the many individuals interested in such a multitude of respects—and for the national character, which cannot fail ultimately to be seriously affected by the currency of such opinions, and by the dangerous practice recommended from such an illustrious source.

Now if Professor Renwick is right, if this his statement is true, it is as evident as the sun at noonday, that the power of an engine using the same fuel and expanding the steam, may not only be readily increased five fold, but ten fold or more; because this plausible theory is altogether based and depends upon an unlimited gain being attainable from a limited cause—stripped of its learned disguise, it would be as unfounded, as were the opinions of those unfortunates seeking perpetual motion.

To prove the unsoundness of these views, as we may, and desire to do, without discussion, we have only to bring the theoretic statements into juxtaposition with Mr. Henwood's experiments, which in density of steam, and in times expanded, though all purely accidental coincidences, are as impartial and correct trials of the theory as could have been contrived by man.

Thus, then, the duty of the Binner-Down engine using steam of 75lbs. elasticity, should have been 300 millions, or more than four times as great as the duty (73 millions) of the East-Crennis engine, using steam of 26lbs. elasticity. But the difference in the duty of these two engines, tried so carefully under circumstances all corresponding with the theoretic statement—with steam exactly corresponding with those prescribed, from which such great advantages are unhesitatingly promised—this difference of duty instead of being as stated, 3 times the duty of the East-Crennis engine, appears less than the $\frac{1}{75}$ part thereof; and even this almost insensible quantity is probably the result of mere accident.

Hence, then, it has been satisfactorily and experimentally proved that steam of 75lbs. per inch expanded, is of no greater value whatever than steam of 26lbs. per inch used expansively; we are thus allowed the choice of only two opinions—either the learned theorist or the unlearned steam-engine must have been mistaken; and, hard though as it may be, we have no doubt this uncandid world will be far more ready to attribute the mistake to the former than to the latter, which, from natural dulness and incapacity, will probably be pitied rather than blamed. But the theorist may even then amply console himself by reflecting, how difficult it is to find an engineer who is not just as much mistaken as himself on this particular subject, for

the very construction of these Cornish engines, and their using steam of such different densities, evidently prove a seeking for some as yet undiscoverable advantage. If he wants farther consolation, let him observe the uncertainty that prevails in the construction of engines, scarcely any two being built alike—or the more brilliant example afforded by the splendid public experiments in which the United States government indulges, who from mere inability to discover the wonderful advantages anticipated in that most exquisite of all steamers, the Fulton, are building two more on different principles and at a venture, determining if possible to discover the hidden perfections of the first. Now we have shown in this paper that one of these second thoughts, the British marine engine, is a poor affair to copy—in our next we will show the other is worse.

If he does not then receive full consolation, let him observe how readily and constantly in all countries is a plausible and lazy, if brilliant, fiction preferred to sober facts demanding study and serious attention. Were facts substituted for fiction in this matter, however trivial they may appear to a superficial and careless observer, it would soon be seen that on the proper application and appreciation of them such an immediate great and general improvement of the steam-engine would ensue, as in its various and total results can hardly be overstated by the most sanguine admirer of that mighty instrument of civilization.

It is in continual shadow hunting that substantial truth is overlooked, and great and real advantages are disregarded: would engineers but condescend to examine and appreciate the true nature of expansive steam; would they but condescend to be satisfied with the great and real advantages it posseses—would engineers (we ask not philosophers) condescend to disburthen or to cease from burthening expansive steam with useless conditions and pernicious and visionary restrictions, destructive of its usefulness, immense improvement would immediately ensue, and soon become general in the steam engine, which luckily never yet became a theorist, and therefore will ever and constantly be found obedient to reason.

Now we have shown, page 162 of this essay, that it is commonly a matter of great, if not perfect indifference, if from a

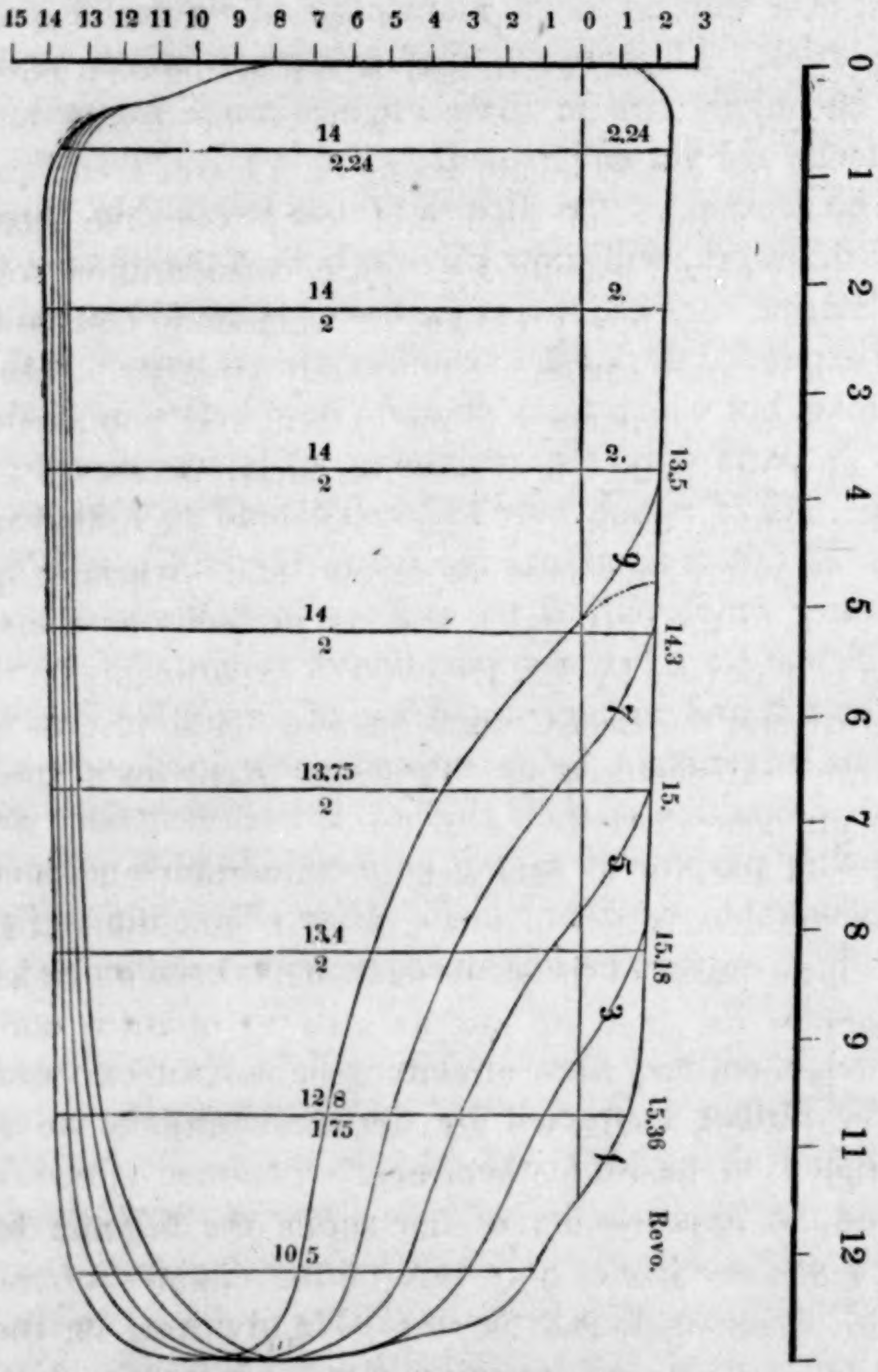
given volume of water and heat whether high steam or low steam is formed and employed to produce motive power.

We have also shown, page 164, the value of gain from steam expanded is ever definite, and proportional to the density of the steam before its expansion. From these two positions it necessarily results, that whether proportional quantities of high or low steam be expanded to produce motive power, the superior quantity of the weaker expanded steam acting on a larger surface, will always compensate for the superior density, but lesser quantity of the denser steam acting on a lesser area; and these two distinct actions of high and low expansive steam will be precisely equal, leaving for future consideration some disturbing forces not now pressing for immediate discussion, and which can be more satisfactorily treated hereafter. These equal actions, though so contrary to the current and popular opinions universally prevailing, are positive facts, necessarily arising from the definite nature of steam definitely expanded within a heated cylinder, and these its certain and invariable qualities are proved to the very letter, and as perfectly as the sagacity of man can devise by Mr. Henwood's experiments on the Binner-Down and the East-Crennis engines; and just as plainly, fully, and satisfactorily are Professor Renwick's theoretical statements contradicted.

We shall attempt to establish an important and invaluable truth on the destruction of this extensive and dangerous error by which the utility of the steam-engine has been much lessened, and happily we shall be just as able to produce undeniable facts in proof as we have already done for all our assertions; so that in every thing we are about to adduce, we shall be supported by indisputable evidence.

For this purpose we annex a fac simile of a diagram described by an indicator attached to one of the engines of the Great Western steam-ship, and like the "Handwriting on the wall," it greatly excels the handwriting of man. It gives a clear insight and full detail of the true internal state and power of the engine under varied circumstances, its capacity for improvement and even the acquirements of the manufacturing engineer—matters essential to be known and difficult to be otherwise determined.

The diagram shows the steam as cut off by cams, (9) five of which are numbered and their effect ascertained, besides that of the slide movement. This engine is undeniably experimental, and the production of a mind seeking and not possessing information of the most essential character conceivable in a marine steam-engine.



8)120.45
15.05
1.05 deduct for friction
14.05 effective pressure per square inch.

On the proper application of steam evidently depend the

form, dimensions, and weight of boilers, water, space and weight of machinery, the quantity and cost of fuel and labor, and the portion of freight usefully employed for those purposes. In fine, the speed, expense, and profit of steam navigation evidently as much depend on the proper application of steam, as this again must ever depend on a knowledge of its useful and definite properties. All these are vital matters in steam navigation on the ocean, and are in those engines much miscalculated, and evidently not yet understood.

The journal of the British Queen steam-ship, page 50, vol. i. of this work, will show how far behind the age are these British marine engines; in a voyage occupying 450 hours the steam was expanded during 388 hours, at what is termed in this journal $\frac{2}{8}$ stroke, but which from diagram now before us of that engine was $\frac{3}{16}$ parts only, the remaining 62 hours mostly $\frac{3}{8}$ parts of stroke, and of which only 18 hours extend to $\frac{5}{8}$ stroke; and we have the fullest assurance the steam in the Great Western was no better employed, as the engines in that vessel are equally insufficient for a better application of steam.

The full and uninterrupted use of expansive steam, with its various advantages being impracticable in these vessels from the disproportion of their engines, is from necessity confined to the paltry purpose of saving an inconsiderable quantity of fuel in unfavorable weather alone. How effectually and profitably may these engines be improved, or how certainly and easily be surpassed.

Thus, then, may another shining light, another learned theorist be farther instructed by the mechanics he so ignorantly attempted to mislead when he so profoundly and learnedly proved the impossibility of navigating the Atlantic by steam; which we, mechanics only as we are, mere dust, are about to prove, has as yet, though so surprising to the intellectual doctor, been but tardily and imperfectly accomplished. A consideration of this diagram will render evident another and considerable advantage in the application of expansive steam, unnoticed by the visionary, unexpected by the practical, but which in large engines becomes of considerable amount by the superior vacuum obtained when steam is greatly expanded; for in this dia-

gram the better vacuum increases the steam pressure when the steam is cut off at $\frac{1}{3}$ stroke a full $\frac{1}{15}$ part more than when compared with steam at full stroke; hence alone there is $\frac{1}{15}$ part additional power to be gained, which is now lost in these engines, in addition to that great gain from the employment of expansive steam.

But the great, the incalculable information contained in and derived from the diagram, is the full proof of that most desirable fact, that the full efficiency of steam is to be obtained from the expansion of low steam; hence we shall find the unlimited and inestimable advantages of steam may be obtained without its horrors and indescribable afflictions, and which are the more dreadful and disgraceful because the use of high steam is as unprofitable as inhuman. ††

[*Note.* An accidental error of transposition occurs in the paper of the preceding number which vitiates a calculation deduced from the diagram and table upon the expansion of steam there given. The period beginning at the 4th line from the top of p. 165, should read thus :

"If the value of steam of 85lbs. pressure per square inch be required when twice expanded; then, as 60lbs. is to 85lbs., so is 659.50 (the sum of the tabular gain by steam twice expanded) to 934.29—and 934.29+850=1784.29; the value required."]

USE OF THERMOMETERS, SACCHAROMETERS, &c. TO MANUFACTURERS AND OTHERS.

No instruments are so much required and so little used as those named in the title of our article, and simply because mystery appears to be preferred to well defined fact.

The distiller, brewer, dyer, &c., make great mysteries of their various methods of determining when their mashes, mixtures and menstruums are at proper degrees of strength, and usually attempt to ascertain it by the taste, touch, and other similar means, each of which are, of course, subject to errors and often fatal to the quality, quantity or regularity of the product.

The degree of fermentation can always be decided by the specific gravity of the fluid, and this is continually changing as fermentation proceeds; therefore, if the distiller and brewer would take the specific gravity of their fluids with a saccharometer, and the temperature with a thermometer, keeping registers of

these facts, they would soon ascertain by absolute experiment when each part of the process had progressed sufficiently to produce proper results, and all future operations would become matters of certainty and not of speculation as they too often are.

Sugar boiling has long been conducted on most unscientific principles; and certain *soi disant* important personages, called boilers, have decided when the sugar is *done* by blowing through a ladle, drawing a thread of sugar between the thumb and finger, biting a small portion between the teeth, dropping it upon a cold spoon, &c. &c. &c. Let the sugar boiler use a *thermometer*, and he will no longer be perplexed by bad results; every operation will be alike, and all at the maximum degree of excellence.

Water uniformly boils at an ascertained degree of heat, but when other substances are held in solution by it, a greater heat is attained before ebulition commences, and as this continually increases from part of the water being expelled by evaporation, the thermometer will continue to rise; therefore, by this instrument alone the strength of fluids at the boiling point can be accurately ascertained.

By the saccharometer slightly altered in form, the machinist can ascertain the purity of oil used for machinery, as its quality and weight are relatively accurate.

By the saccharometer the soap boiler can at once test the strength of ley, and the house-wife judge with accuracy when sufficient salt is dissolved to preserve meats—and she knows her *sweet meats* are done when the thermometer rises to 240 degrees.

Glass saccharometers on Beaumè's scale can be purchased for 50 cents, and are so constructed as to be used for fluids both heavier and lighter than water.

MECHANICS' INSTITUTE.

This useful institution is about commencing its operations for the winter. The conversational meetings will be held every Tuesday and Thursday evening, and a lecture delivered every Monday evening during the winter, to commence on the 15th instant. The Lecture Committee have reported a programme that will do credit to the Institute.

The Committee on Classes have already commenced establishing classes in architectural and mechanical drawing, chemistry, French, &c.

The School Committee report a large increase of scholars at the day school, and the Library Committee an increased number of readers.

We cannot conceive a more rational mode of passing our leisure hours during the winter than by embracing the advantages of this institution. At the conversational meetings, any member may propose the subject most interesting to him, and in one hour avail himself of the reading and experience of one hundred persons; thereby acquiring more information than he could possibly obtain on the same subject by any other means. Such subjects as cannot be thus treated, from requiring illustration, or from other causes, are explained by the lectures; and such as require personal application, can be obtained by attending the classes. Those fond of reading have the use of a well-selected library, and the most useful scientific periodicals of the day.

MECHANICAL FAIRS.

These exhibitions appear yearly to increase in interest and usefulness: they are emulative, and consequently advantageous. At a glance the spectator is enabled to ascertain the improvements made within the past year, and inventors have an opportunity of exhibiting their works without cost. These facts are fully appreciated by the public, and we find the fairs daily crowded by thousands of visitors.

The Franklin Institute, of Philadelphia, and the American Institute, of New-York, have both held fairs during the past month. We have visited both; and, notwithstanding the calamitous times, which it was feared had paralyzed the energies of our manufacturers, they are filled with novelties and useful improvements. Did our space permit, we should willingly detail those objects most worthy of notice; but to name them, even without comment, would occupy an entire number.

WOOD ENGRAVING APPLIED TO THE MECHANIC ARTS.

The art of engraving on wood, particularly in its present advanced state, has been much and justly lauded as a cheap, correct and efficient medium for the dissemination of useful knowledge respecting *things*—their form, structure and relation to each other. But its application to the mechanic arts has, we think, received entirely too little attention; and it is our design to point out as briefly as possible, at the present time, one or two of the peculiar advantages of this useful art in this connection.

Its advantages are particularly apparent in the construction of machinery consisting of many and complicated parts, and requiring the labor of several artisans at the same time. In order to have the several parts made with accuracy, so that the machine may be perfect as a whole, and at the same time to relieve the master workman from the duties of constant personal supervision of every part, drawings—generally termed *working drawings*—are essential. To execute these when a large number is required, as in the case of extensive manufactories of steam-engines, much labor is spent, and the slightest accident from fire may in a moment destroy the labor of days, and hinder the workmen from proceeding. But if all the parts of machinery necessary to be drawn are engraved on wood of a reasonable size, a great number of copies can be made with a trifling expense, and an accident like the one just mentioned could not cause serious inconvenience or loss. The first cost of such engravings is very reasonable, and the price for multiplying copies far less than by any other mode.

Again: When an inventor produces a new machine or useful apparatus, and it will be to his own advantage and that of the public to give it great publicity, there is no mode so facile and cheap as that of a correct engraving on wood, representing his machine or apparatus in perspective and sections, in a manner so perspicuous that its advantages may be at once clearly comprehended. These engravings, published in any of the scientific journals or newspapers of the day, make the public acquainted

with the new inventions, and far more conversant with its utility than they possibly could be by a simple description, however minute in its details. The consequence of this practical information is a corresponding extension of patronage on the part of the public to the inventor or manufacturer.

Inventors who are obliged by law to transmit a drawing and duplicate of their machine or apparatus to the Commissioner of Patents, can have an engraving on wood of their article made instead at a cost not to exceed that of a drawing and duplicate, and then they are prepared to multiply duplicates, if they wish, to any extent; and they also possess an efficient medium through which to make their invention known to the public. All kinds of machinery, &c. can be engraved as neatly and effectively on wood as in any other way, and the cost of printing is far less. Many other advantages of this art in connection with mechanics might be named and proven; but our limits will permit us only to make these brief suggestions, with the hope that mechanics will give to the subject proper attention.

NOTICES OF NEW PUBLICATIONS.

First Principles of Chemistry. By James Renwick, *LL. D. Professor of Chemistry and Natural Philosophy, Columbia College, New-York.* Published by Harper & Brothers.

We have read this volume with much pleasure, and most cheerfully recommend it as the best work for beginners we have yet seen. Most works of this sort detail simply the more glaring or amusing chemical facts, and the student contents himself with being able to make great lights, offensive odors, galvanic shocks, and a few other nonsensical and expensive experiments, to alarm or amuse his associates. He never dreams of performing a useful analysis, nor has he any means of applying chemistry to useful purposes after reading what are usually called elementary works. The volume before us not only gives the usual detail in a comprehensive manner, but has a few pages devoted to simple and useful analyses, with the modus operandi and rationale fully explained; thus enabling even a beginner to feel and understand the importance of synthetical and analytical chemistry. The Professor has done himself an honor, and our youth an essential service.

The Maryland Medical and Surgical Journal.—Edited by a Committee of the Medical Faculty of Maryland. Baltimore: Published by John Murphy.

This periodical presents strong claims to public patronage, and will doubtless be well supported. The articles headed "Contributions to Pathology," and "Hospital Reports," are highly meritorious. We have selected two articles on Daguerreotypes and Daguerreotype plates, by Drs. Aikin and Garlick, which we recommend to a careful perusal.

PROGRESS OF THE MECHANIC ARTS.

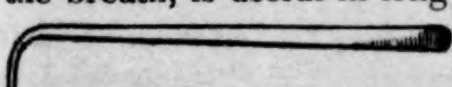
Suggestions for the Use of the Blowpipe by Working Miners. By JOHN PRIDEAUX, *Esq., F. G. S. Cornwall.* [Communicated to the London "Mining Review" for April, by the author.]

It is a leading principle of the present day, that artisans of every kind should be instructed by means of mechanics' institutes, or other mediums of communication, in the scientific as well as practical elements of their respective arts—a principle, the benefits of which not being confined to its particular objects, it must necessarily, in thus multiplying operative intelligence, advance the arts and manufactures of the country.

In conformity with this principle, I am induced to offer some suggestions for the easy and effectual application of the blowpipe to metallurgy by working miners—a class of men who have hitherto received but little assistance from the scientific world. If the practice should gain ground amongst them, the satisfaction of the individual workman, in understanding the quality of every ore he encounters, and in having it in his power to examine any mineral he may suspect to be metalliferous, is but one part of the advantage that may be anticipated. When it is remembered that the gray sulphuret of copper, the richest ore of that metal, was until of late years thrown on the mining heaps for mundic; and that even all the copper ores were rejected for centuries by the tinners as worthless, how many other substances may we not hope to save from the waste heaps, or the deads below, when the thousands of persons engaged in working the mines shall have their curiosity and cupidity thus excited?

The simple instruments and materials described hereafter, will be easily procured and generally sufficient. The miner who desires further instruction may have recourse to a little book, containing, in small compass, and at small cost, much valuable information—"Griffin on the Blowpipe;" or the more scientific work of Berzelius, translated by Children, which, however, requires more chemical knowledge.

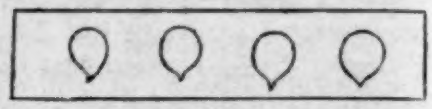
For ordinary metallurgic assays, the common blowpipe does very well; a mere tapering tube ten inches long, half an inch diameter at one end, and the opening at the other scarcely equal to admit a pin of the smallest kind, the smaller end curved off, for one and a half inch, to a right angle. A bulb at the bend to contain the vapor condensed from the breath, is useful in long operations, but may generally be dispensed



with. In selecting the blowpipe, the small aperture should be chosen perfectly round and smooth, otherwise it will not command a good flame. A common candle, such as the miner employs underground, answers very well for the flame.

To support the subject of assay, or "the assay," as it has been happily denominated by Children, two different materials are requisite, according as we wish to calcine or reduce it. For the latter purpose, nothing is so good as charcoal; but that from oak is less eligible, both from its inferior combustibility and from its containing iron, than that from alder, willow, or other light woods.

For calcination, a convenient support is a cupel of white clay, selecting such as will not fuse, nor become colored, by glazing with borax. They are easily made, as follows: In a slip of sheet copper or brass, 3 or 4 inches long, about $\frac{5}{8}$th wide, and 1-30th or 1-32d thick, have four our five round holes, from $\frac{1}{4}$ to $\frac{3}{8}$ of an inch diameter, their inner edges being kept smooth and clean. Place this on a slip of paper, and fill the holes with clay, prepared as below, removing the excess with a clean knife (of ivory or bone, if at hand).



Turn out the cupels, and hollow them 1-16th to $\frac{1}{8}$th inch deep, by pressing each in the hollow of the hand with the round end of a glass tube, the round brass head of a nail, or a very small marble stuck on a cork. This instrument must be very clean, lest it should communicate a false color to the cupel when borax comes to be melted on it, and may be rubbed across your forehead each time before pressing the clay, to prevent adhering, by the little greasiness it acquires from the skin. A little handle for holding in the forceps is easily given them, by notches in the edges of the holes, as in the figure.

Good white pipe, such as the Poole clay, answers very well, but is improved by an equal mixture of China clay. It should be mixed soft enough to bear the hollowing down without cracking, but not so as to stick to the hand or the edges of the hole. They must be dried gently, say an hour or two, before the fire, and may then be baked at a bright red heat, in a small crucible or tobacco-pipe.

They should be baked in a clear fire, to keep out coal-dust and smoke as much as possible, as either of these adhering to the clay-plates would color the borax in melting. A small fragment of the bowl of a new tobacco-pipe will serve instead, in the absence of a more convenient material.

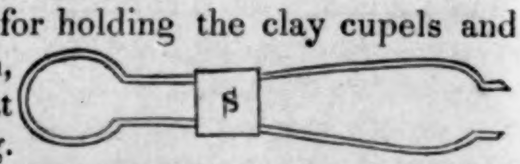
These cupels are useful, not only for calcination, but also for ascertaining the colors of oxides with borax, in the oxidating flame, as will be presently explained.

A simple pair of forceps, to move and take up the hot assay, may be made of a slip of stiff tin-plate, eight inches long, half an inch wide in the middle, and one-sixteenth of an inch at the ends.

The tin being rubbed off the points on a rough whetstone, the slip is to be bent until they approach each other within half an inch, and the

two sides are parallel; thus there will be spring enough in the forceps to open and let go the assay, when not compressed upon it by the finger and thumb.

Another kind of forceps, convenient for holding the clay cupels and fragments of minerals, is formed of iron, turned as annexed, and hammered flat at the points, to give the better holding.



It opens by its own elasticity, and has a tin slider (S) to close the points and keep hold of the cupel, or other subject of operation. Of course, the points must not touch the melting borax, as they would tinge it with iron. Either of these will be made by a tinman for a penny.

A magnetic needle, very desirable to ascertain the presence of iron, is easily made of the requisite delicacy where a magnet is accessible. A bit of thin steel-wire, or a long, fine stocking-needle, having quarter

of an inch cut off at the point, is to be heated in the middle, that it may be slightly bent there, thus: While hot, a bit of sealing-wax is to be attached to the centre, and the point which was cut off being heated at the thick end, is to be fixed in the sealing-wax, so that the sharp end may serve as a pivot, descending about $\frac{1}{8}$th of an inch below the centre, taking care that the ends of the needle fall enough below the pivot to keep it from overturning. It must now be magnetized, by sliding one end of a magnet, half-a-dozen or more times, from the centre to one end of the needle; and the other end, a similar number of times, from the centre of the needle to its other end. A small brass thimble (not capped with iron) will do for the support; the point of the pivot being placed in one of the indentations, near the centre of the top, when, if well balanced, it will turn, until it settles north and south. If one side preponderate, it must be nipped until the balance be restored.

A black gun-flint is also occasionally used to rub the metallic globules (first attached whilst warm to a bit of sealing wax) and ascertaining the color of the streak they give; thus minute particles of gold, copper, silver, &c. are readily discriminated.

A little refined borax and carbonate of soda, both in powder, will complete the requisites.

Having collected these materials, the next object for the operator is to acquire the faculty of keeping up an uninterrupted blast through the pipe, whilst breathing freely through the nose.

This is easier to learn from example than from written instructions; yet, with attention, I believe the following will be found generally sufficient.

Any one free from nasal obstruction can breathe freely through the nose with the mouth closed. Having done this for a dozen successive respirations, let him inflate the cheeks, and keep them so by pressing the tongue against the roof of the mouth. In this manner he will immediately, or very soon, be able to breathe through the nose just as freely with the cheeks inflated as in the ordinary state.

When he can do this without effort, the large end of the blowpipe is to be taken between the lips, and the mouth inflated as before. The pressure of the cheeks will thus force a stream of air through the pipe, and the mouth will quickly become nearly emptied.

It must then be inflated a second time, by forcing in air from the lungs, over the tongue, and again suffered to empty itself through the pipe, by the pressure of the cheeks, continuing the respiration all the while, at ease, through the nose. When this has been repeated several times, so as to have attained the power of breathing calmly, whilst the current through the blowpipe is produced entirely by the action of the cheeks, the next step is made by forcing in air over the tongue, *before* the mouth has completely thrown out the air it contains, and whilst the current is still continuing through the pipe. Thus he may keep up a continuous blast for a quarter of an hour or more, without impeding his respiration, and with no other fatigue than of the lips where they press the pipe.

The next lesson is the regulation of the blast. For this purpose, a candle with a longish snuff is to be lighted, and placed in a sloping position, the upper part of the wick being bent down nearly horizontal

toward the same side as the candle leans. It is to be so placed that the operator, with both elbows leaning steadily on the table, can apply the point of the blowpipe just behind the flame, so as to blow it along the bent wick. The blowpipe should not quite touch the flame, and should direct it a little clear of the wick, that the jet may be round and smooth. When properly produced, it will consist of a clear blue-pointed flame inside, with a yellow or reddish transparent outer one. If the outer flame be bright, dense, and sooty, like the ordinary flame of a candle, it indicates that the blast must be stronger, or that the aperture of the blowpipe must be enlarged, or brought closer to the flame, unless a smaller candle be employed.

Now, supposing the operator to have produced a clear smooth flame, which does not smoke the edge of a sixpence, placed at the blue point within it, let him rest the bend of the blowpipe as well as his elbow, so that the instrument may remain perfectly steady. He must now practice until, by regulating the pressure of his cheeks and the filling of his mouth from the lungs, he can keep the jet, without puffs and jerks, as constant and firm as the pipe itself.

Let him next make a little cavity (two or three times the size of a split pea) in a piece of charcoal, and putting therein a fragment of malachite (green copper) not much larger than a mustard-seed, bring it up to the flame, so that the inner blue point shall act directly upon it: in a few seconds he will find it reduced to a bead of malleable metallic copper. Continuing the blast, let him remove it into the outer flame, almost to the extreme point, he will soon find it covered with a crust, and if put on one of the pipe-clay cupels, it will be calcined throughout by the action of the external flame, and crumble under the blow of a hammer. Hence he will learn the third lesson, that the flame answers the double purpose of the calcining and reducing furnaces; the outer flame being the calciner, the inner one the reducer. And this is the most important point of blowpipe knowledge.

The reducing action is increased by removing the blowpipe a little farther from the wick, so as to give the external flame more density, and a slight tendency to smoke the assay. The calcining action, on the contrary, is promoted by putting the point of the pipe quite into the flame of the candle, so as to make the outer flame of the jet very transparent, and only just visible. A little harder blowing is suitable for calcination than for reduction.

Most of the ores having a metallic aspect (as yellow and gray copper, lead ore, mundic, white cobalt, &c.) contain sulphur, and require much calcination before being reduced; otherwise, the globule may be deficient in quality or quantity, or both. Some of them fly on being heated, in which case the flame must be brought upon them gradually, letting it first pass over them, and raising them very slowly into it. But there are some which decrepitate and fly about when heated even in this cautious manner. With these it is necessary to use a second piece of charcoal as a cover. For this purpose, taking two pieces, each having a flat side, two inches long, let a groove be cut along one of them about a quarter of an inch wide and deep, and a cavity of the usual size in the middle of the other. Place in the cavity a fragment of assay, four or five times as large as usually employed, and put the grooved piece over

it, so that the flat sides shall coalesce, and the cavity fall under the groove. The blowpipe jet, being then sent along the groove, will soon cause the assay to decrepitate, whilst the greater part of the projected fragments will be caught in the groove. Or, when intended for roasting in a clay cupel, the ore may be powdered at first, after which it seldom decrepitates.

As soon as the decrepitation is finished, the jet should be discontinued, and the assay thrown out on a plate. A particle will then most likely be found large enough to work upon; but if not, the operation may be repeated on a larger piece, or a good knob of it heated red, in the bowl of a tobacco pipe, covered, in a common fire. After once heating red, the assay is no more subject to decrepitation.

In calcining ores, care should be taken not to melt them, as that retards the process; the heat should be applied at first gently, keeping the assay beyond the reach of the flame, and approaching as the sulphur is driven off, and the assay becomes less fusible. This process should be performed on the pipe-clay cupels, applying the flame beneath, first worked together with moisture, if in powder.

When the sulphur, &c. is entirely driven off, (which is sometimes a good while after the smell has ceased) the assay should be removed to the charcoal, and tried in the reducing flame—a little soda being added if reduction does not readily ensue. If it still refuse to yield a metallic globule, it may be cooled quickly by being dropped on a knife-blade, or into a silver spoon, and then taken up on a bit of wax, and tried with the magnetic needle. If, on approaching or touching one of the ends of this instrument when mounted, as above described, a strong attraction be manifest, the assay is probably iron, which may be farther proved, as hereafter stated. If it do not produce a bead, or if the bead produced be not easy to recognize by itself, or by the streak it produces on a black gun-flint, a minute portion of it is to be melted with a little borax, in the reducing flame, on a clean surface of the charcoal, taking the precaution to melt the borax first, and see that it produces a colorless, transparent bead. If it be either colored or opaque, after good fusion, it is unfit for the purpose, and another must be made at a different part of the charcoal. The borax will swell and twist (like burning leather) in melting, but is easily brought back to a bead by a little management of the hand.

If, when a portion of the assay is melted in it, the borax remain colorless and transparent, more assay is to be added, and the addition continued until it manifest some color, or can no longer be rendered transparent; or, if the color be too dense to be distinguished, more borax must be used. A portion of borax is then to be fused, upon a pipe-clay cupel, over the surface of which it will spread like a glaze, and will impair its whiteness, but must exhibit no particular tint of color: if it do, another piece must be employed. A minute portion of the assay, or rather of the borax bead containing it on the charcoal, is now to be added, and well fused on it in the reducing flame, increasing the dose of assay, or of borax, as before, unless color be manifested.

Some of the metals are volatile, and will give neither bead nor color to borax, but evaporate before the blowpipe in a white smoke, often of a strong odor, sometimes covering the charcoal with a white powder,

or depositing a circular halo upon it, white or colored, at a little distance round the assay. This halo may be again driven farther, or dispelled, by the action of the flame—generally of the reducing flame, but sometimes of the other. By these characteristics the volatile metals may be distinguished as effectually as if they left a bead. It happens also, frequently, that a volatile metal is combined with one that is fixed, as in white mundic, composed of arsenic and iron. The blowpipe then separates them—the arsenic driven off is known by its smell, and the iron remaining by its action on the magnetic needle. But when two or more volatile metals are united, or two or more of the fixed kind, they are less easy to discriminate, and require both practice and study.

The following rules may generally be relied on; but in cases where the assay gives ambiguous or complicated indications, proportionate caution is necessary, both in operating and deciding. The miner will commonly judge a mineral to be metallic, if it has a metallic aspect, not destroyed by scraping, or if it feels particularly heavy in the hand; but others also discover metallic properties to the blowpipe, by

1. Yielding a bead of metal to the reducing flame, on charcoal, which is facilitated by the addition of soda.
2. Passing off in vapor more or less dense.
3. Attracting the magnetic needle, after heating in the reducing flame on charcoal.
4. Coloring borax strongly, either on charcoal or pipe-clay.

When a metallic bead is produced, it may be pure silver, tin, lead, bismuth, copper, gold, or iron; copper, nickel, or cobalt, alloyed with arsenic, or a mixture of various metals.

Gold and silver may be distinguished by not losing their brilliancy in the outer flame; tin by its whiteness and softness; lead and copper are immediately distinguished by their color; and bismuth by fuming and evaporating in the reducing flame. The arsenical alloys and compounds, not clearly distinguishable by these means, nor by their streak upon the black flint, must be examined by fluxing with borax.

If it give green on pipe-clay, it is copper, though it happen to be bleached by the arsenic.

If blue, it is cobalt.

If orange yellow while hot, and the color fly on cooling, it is iron or nickel; and these are distinguished by their reducing flame on charcoal, where the borax bead is bottle-green with iron, but almost colorless with nickel.

If the metal yield no bead, but pass off in vapor, it is quicksilver, arsenic, antimony, bismuth, or, possibly, tellurium, cadmium, or zinc.

If the vapor smell strongly of garlic, it is arsenic.

If it leave a circular halo on the charcoal, it is antimony, tellurium, bismuth, or cadmium.

If the halo be white, it is antimony.

If orange yellow, it is to be subjected to the reducing flame. If it disappear easily, tinging the flame green, it is tellurium.

If it evaporate with difficulty, and without tinging the flame, it is bismuth.

If it be red, or orange red, it is cadmium.

If the mineral evaporate readily with no odor, or only that of sulphur, and without leaving a white or yellow halo, it probably contains quicksilver, which is proved, if, on mixing a portion of it with soda and iron filings, heating it on charcoal, and holding a bit of gold coin on the vapor, the quicksilver show itself on the coin.

If, using soda with the reducing flame, the assay burn, after a while, with a pale green flame and white smoke, covering the charcoal with a white, flaky powder, it contains zinc.

If it will neither yield a bead of metal nor volatilize, but attract the magnetic needle after the operation of the reducing flame, it most probably contains iron, but it may be nickel or cobalt—easily distinguished by fluxing with borax.

If the mineral, or the residue, after part has evaporated, will neither yield a bead, volatilize, nor attract the magnetic needle, we have then to flux it with borax, and the following table will show what it contains:

If it stain the Borax,		The metal is	Estimation.
In the reducing flame, on charcoal.	In the calcining flame, on pipe clay.		
Blue	Blue	Cobalt	Valuable for coloring glass, &c.
Bright green	Colorless	Chrome	Ditto, ditto, and for paints.
Colorless or reddish	Blueish green	Copper	Valuable.
Bottle green	Orange, while hot, bleaches in cooling	Iron	Of no value unless near coal.
Pale	As iron	Nickel	Valuable.
Dirty green	Yellow	Uranium	Not used.
Purple	Colorless	Titanium	Ditto.
Colorless	Purple	Manganese	Valuable for bleaching, &c.

Copper is reduced to the metallic state in the reducing flame; and hence, when in quantity, shows itself in its usual red color in the bead.

In mixtures of metals, the indications are sometimes ready enough. If, on pipe-clay, we find the borax tinged between orange and purple while hot, and becoming purple on cooling, whilst it gives a bottle-green on charcoal, we immediately perceive the indications of iron and manganese—a very common mixture. If, again, we find it bright green on pipe-clay, and emerald green on charcoal, a mixture of chrome and copper is indicated. But it more frequently happens that mixtures of metals give ambiguous results, and that they can only be ascertained by caution and perseverance.

Although most of this is sufficiently easy, it requires a little practice; and to give the operator confidence in his results, this is best performed upon substances which he knows to contain the metals he assays for. Thus, if he operate on common mundic, he is certain, after a sufficient time of roasting and heating on charcoal, to obtain a residuum capable of affecting the magnetic needle. White mundic will leave the same residue, after giving off an arsenical smoke. Green copper (malachite) will be sure to yield a bead of copper on charcoal, and will as certainly produce a fine green with borax on pipe-clay. Any of the ores of lead may be promptly reduced to a metallic bead on charcoal.

The vapor of antimony may be easily distinguished from that of ar-

senic, by the garlic odor of the latter. A minute particle of manganese will tinge borax a fine purple, on pipe-clay, in the outer flame; but on charcoal, in the blue flame, a much larger portion, dissolved in borax, will become limpid and colorless. A particle of titanium ore will give an opposite result, bleaching on the pipe-clay, and becoming purple on the charcoal.

The experimenter should also not fail to reduce tin ore by the aid of soda, and some ore of zinc by the same means, that he may become acquainted with the appearances in these assays. Thus varying his practice as materials happen to fallen in his way, he will quickly acquire familiarity with the appearances and results, and feel confidence in any assay he may undertake.

Should he wish to carry his investigation farther, and ascertain the proportion of metal contained in the ore, this may be done on a small fragment of anything which yields a regulus, and by an instrument so simple, that a clever workman may make it for himself.

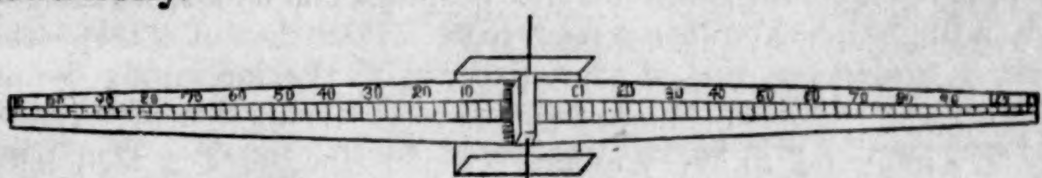
The common marsh-reed, growing in such places, generally throughout the kingdom, will yield straight joints, from 8 to 12 or more inches long. An 8 inch joint will serve; but the longer the better. This joint is to be split down its whole length, so as to form a trough, say a quarter of an inch wide in the middle, narrowed away to one-eighth of an inch at the ends. A narrow slip of writing paper, the thinner the better, (bank-post is very convenient for the purpose) and as long as the reed trough, is to be stuck with common paste on the face of a carpenter's rule, or, in preference, that of an exciseman, as the inches are divided into tenths instead of eighths; in either case observing that the divisions of the inch on the rule be left uncovered by the paper. When it is dry, lines must be drawn the whole length of it, one-eighth of an inch apart, to mark out a stripe one-eighth of an inch wide. Upon this stripe the divisions of the inch are to be ruled off by means of a small square.

The centre division being marked O, it is to be numbered at every fourth line, to the ends. Thus, the 4th from the centre on each side will be 10; the 8th, 20; the 12th, 30; the 16th, 40, &c.; and a slip of 10 inches long, graduated into 10ths of an inch, will have on each arm 50 lines, or 125 degrees, taking four lines for 10 degrees, or $2\frac{1}{2}$ degrees each line. While the lines and numbers are drying, *the exact centre* of the reed-trough may be ascertained, and marked *right* across by spots on the two edges. A line of gum-water, full one-eighth of an inch wide, is then laid, with a camel's-hair pencil, along the hollow; and the paper being stripped from the rule, (which it leaves easily) the graduated stripe is cut out with scissors, and laid in the trough, with the line O exactly in the centre. Being pressed close to the gummed reed, by passing the round end of a quill along it, it graduates the trough from the centre to each end. This graduation is very true, if well managed, as the paper does not stretch with the gum water, after being laid on the rule with paste.

A very fine needle is next to be procured, (those called *bead* needles are the finest) and passed through a slip of cork, the width of the centre of the trough, about a quarter of an inch square, and one-eighth thick. It should be passed through with care, so as to be quite straight. The

cork should then be cut, until one edge of it fits into the trough, so that the needle shall bear on the edges, exactly in the spots that marked the centre, as it is of importance that the needle and trough be exactly at right angles to each other. The cork is now to be fixed in its place with gum water, and, when fast dry, to be soldered down on each side with a small portion of any soft resinous cement, on the point of a wire or knitting-needle. A little cement being also applied in the same manner to the edges of the cork where the needle goes through, to give it firmness, the beam is finished. It may be balanced by paring the edges on the heaviest side, but accurate adjustment is needless, as it is subject to vary with the dampness or dryness of the air.

The support on which it plays is a bit of tin-plate, (or, in preference, brass-plate) $1\frac{3}{8}$ of an inch long, and one inch wide. The two ends are turned up square $\frac{3}{8}$ths of an inch, giving a base of $\frac{5}{8}$ths of an inch wide, and two upright sides $\frac{3}{8}$ths high. The upper edges are then rubbed down smooth and square upon a Turkey stone, letting both edges bear on the stone together, that they may exactly correspond. For use, the beam is placed evenly in the support, with the needle resting across the edges. Being brought to an exact balance by a bit of writing paper, or any other substance placed on the lighter side, and moved toward the end until the equilibrium is produced, it will turn with extreme delicacy—a bit of horse-hair $\frac{1}{8}$th of an inch long being sufficient to bring it down freely.



[Proper length ten to twelve inches.]

This is used as follows: A suitable portion for an assay, say one to three grains of the mineral to be tried, is placed on one side of the beam, and counterpoised by a small weight, or any other substance, on the other side: on no. 100, if the produce be required per cent, (but if per cwt. on the line beyond no. 110) the assay piece being moved to or from the centre until the balance is adjusted. Its exact place on the beam being then noted, it is to be taken off and reduced in the usual manner.

If it requires roasting in a cupel, it may be balanced therein, but the cupel must first be heated red, that its weight may not change during the operation, and then be balanced by a separate weight from that which counterpoises the ore, and is to be moved to indicate the changes in the assay; and as in this case the cupel must not be moved towards or from the centre, after being balanced, the powdered ore must be adjusted to its counterpoise weight, placed on 100, by taking out or putting in a little, as the case may require, and not by moving, as when no cupel is used.

When the reduction is complete, and the particles of metal have been brought together into one bead, it is allowed to cool, and, being broken out of the soda, (if any was used) is replaced on the beam precisely where it stood before; or the loss or gain in roasting may be ascertained

in the same manner. The counterpoise will now require to be moved towards the centre, in proportion to the loss of the assay. The number on which it stands, when the balance is restored, will give the produce per cent, or per cwt. according to the first position of the counterpoise.

A beam of this kind is described in the "Annals of Philosophy," of a graduated thin slip of deal, the needle fixed on with sealing-wax; but this is rather troublesome to graduate, the polish of the needle is apt to be impaired by the heat, its greater weight also interferes with its delicacy, and a blowpipe bead is very subject to fall off its flat surface. On these accounts I find the reed beam an improvement. Brass plate is, however, where procurable, preferable to tin-plate for the supports; and, still much better, two straight bits of fine glass rod or tube, fixed with cement on the edges of a groove, in a piece of wood of the requisite dimensions.

PROGRESS OF SCIENCE.

On the Effects of the Curvature of Railways. By EDWARD SANG, *Esq. Civil Engineer, Edinburgh, M. S. A.* [Read before the Society of Arts for Scotland, 27th May, and communicated to the Edinburgh New Philosophical Journal.]

The prodigious velocity which is now attained on railways, brings out prominently all the defects of their construction, and renders it necessary to attend to every minute circumstance. It is well known that when a railway train is moving upon a curve, there is a tendency to go off the rail, and to continue the rectilineal motion. To prevent the bad effects of this, the outer rail is raised to such a degree as that the line laid across the rails may be perpendicular to the resultant of gravity and the centrifugal force. This precaution completely removes all tendency of the wagons to move off the rail, and all pressure against the ends of the axes. The point to which I wish to draw the attention of the Society is the transition from a straight line to a curve, or from one curve to another.

It is considered by some to be sufficient that the straight part of the rail be tangent to the circle which forms the curve; or that the circular parts of the rail have a common tangent at their junction. By this means any sudden angle is avoided; but this is far from sufficient for the exigencies of railway traveling.

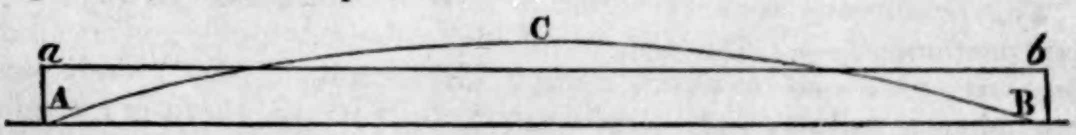
To see the nature of the defects of this plan, let us follow a wagon in its course from one direction to another. The instant that it leaves the straight line and comes upon the circle, there is the centrifugal tendency; and there must be a rise in the outer, or a depression in the inner rail. Suddenly the passengers, endeavoring (without being aware of it) to continue moving in a straight line, feel themselves pressed to the one side of the carriage—slightly it may be—but still suddenly. The rise in the rail cannot be instantaneous; and thus, either before or after the change of curvature, there is a want of proper adaptation.

Such must necessarily be the result wherever the transition from one degree of curvature to another is sudden.

This inquiry therefore offers itself: What ought to be the nature of the curvature of railways?

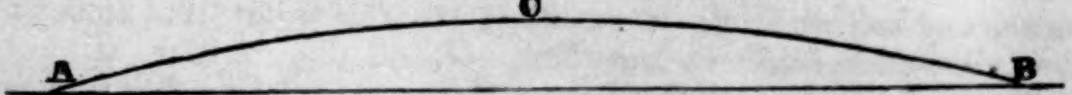
One thing is certain, that the change of curvature must never be abrupt, and that the junction of circular arcs is inadmissible.

Viewing the distance measured along the rail as the absciss, the curvature may be regarded as a function of that distance; and this function must be of such a nature that the curvature may be zero at the point where the deviation from the straight line commences. Putting l for the length reckoned from this point, and s for the curvature, the simplest function which satisfies this condition is $s=nl$. That is, the curvature is proportional to the distance from said point. But this function is insufficient for the purpose, since it would give a perpetually increasing curvature, while the general object of a railway curve is to lead us from one direction to another—to join two straight parts of the line. For this purpose the curvature must increase, reach a maximum, and again diminish to be zero at the place where the second straight part is reached. The simplest function which possesses the requisite properties for this is $s=nl\,(L-l)$, where L is the whole length from the one straight part to the other. A curve possessing this characteristic would be entirely free from the fault to which I have pointed; yet, pushing our examination still more narrowly, it would not be altogether free from defects, since the vertical projection of the outer rail (suppose stretched in a straight line) would be parabolic.



Thus, A and B representing the two ends of the curved part, and AB the level of the inner rail, the parabola ACB would represent the level of the outer rail; in the case of the circular sweep, the line $a\ b$ would represent it with a sudden stop at each end. The curve ACB must undoubtedly be preferable to the line $Aa\ bB$ (which, in fact, never can be adopted in practice) yet even it must give a harshness at the points A and B, which harshness must augment as the second power of the velocity.

The curve ACB ought to have touched the straight line at the two points A and B, it ought to have presented an appearance of this kind.



Let us retrace the steps of the successive improvements at which I have hinted. First, we have the function $s=\frac{1}{r}$ (constant), of which the first derivative is zero. Second, $s=nl$, of which the second derivative is zero; and, thirdly, $s=nl\,(L-l)$ of which the third derivative is zero; the softness of the action increasing with the number of derivatives. For further improvement, we must take a function of an order still higher. Now, supposing these functions to be completely resoluble into

factors, the curve given by them will have as many points of reflexure (or of straightness) as the function has dimensions, and the curve will present a waved appearance. I need not indicate to those who are acquainted with the higher analysis, how the thorough investigation of such curves surpasses the present powers of that powerful science. Such persons will at once recognize in the curve of sines a transcendental function, having an intermediate succession of derivatives, and whose form, easily submitted to calculation, embraces all the essentials of which we are in search.

I therefore submit, as the proper sweep for joining two straight parts of a railway, that portion of the curve of sines which is contained on one side of its axis, and I subjoin a few practical rules for its adaptation.

PROGRESS OF STEAM NAVIGATION.

Report of Count Daru to the French Chamber of Deputies, in the name of a Special Commission intrusted with the examination of a projected Law relative to the establishment of Steam Packets between France and America. [Translated from the French for the London Times.]

GENTLEMEN—A high regard for the interests of the public has given rise to this projected law, of which we are about to render an account. The point in question is, the establishment of these means of conveyance which, in long voyages, give to sea traveling a regularity and dispatch which might be compared to that which we have already obtained on railways. The experiments lately performed at Liverpool, and which were crowned with such brilliant success, prove that for the future the vast expanse situated between Europe and the two Americas is no longer inaccessible to steam. By means of powerful machines, steam packets traverse the ocean: the compass is their guide; steam gives them the means to maintain the direction which they should take; so that, thanks to the happy assistance of these two great inventions of the human genius, the irregularity of arrival, the uncertainty and delay incident to sail navigation, are dispelled, and give place to regular, expeditious, and safe passages.

It was in 1807 that the first steam-boat appeared: it was constructed by Fulton: its engine had a power of 18 horses, and accomplished the passage from New-York to Albany in 33 hours. It was the lot of North America, whose streams, lakes, extensive coasts, interrupted by enormous bays, and covered with islands, are so well adapted to the establishment of steamers, to enter the first in this career, and to cement by means of this wonderful instrument of communication the bond of unity between the population scattered on its soil in a state of isolation, and almost completely without communication with each other.

The progress of steam navigation there was rapid. We see in an official report presented on the 13th of December, 1838, to the American Congress, by the Secretary of the Treasury, that 1300 steam-boats have been built in the United States from 1808 to 1839: of these, 800 are still serviceable.

In England, the first steamer was launched on the Clyde, in 1811. It is not uninteresting to see the progress made by Great Britain in this particular. The last statistical reports published at Liverpool give on this point the following data:

There were in 1812 only 2 steam-boats in England; in 1814 only 5; in 1825 there were already 168; in 1835, 538; in 1839, 840.

We here see in what a considerable ratio these numbers have successively increased.

In France the first attempts date scarcely sooner than from 1820, and it was only in 1826, after many fruitless attempts, that a regular service of steam packets was established on the Saone. Our progress, therefore, has been slow in the career which other nations had thrown open. The cause of this is perhaps the bad state of our rivers. The Rhone is an impetuous stream, and difficult of ascent. The Loire, extensive and changeable in its course, offers a depth of water which is frequently insufficient. The Seine has its frequent bends. Now, in every country steam navigation was in the first place established on rivers, because their course offers fewer obstacles, requires less powerful engines; in short, presents greater facilities for circulation than are offered by the sea. For several years, however, our advancement has been evident. In the last account given by the marine administration, we see that in 1833 we had 75 steam-boats; in 1834, 82; 1835, 100; 1836, 105; 1837, 124; 1838, 160. This statement does not include government steamers, of which there are 38, carrying engines of from 160 to 250 horse power.

Thus, England holds the first rank, the United States the second, and France the third.

The form, dimensions, and power of steam-boats, evidently depend on the service to which they are destined. They were not long merely employed in the ascent and descent of rivers, but soon the limits of steam navigation were enlarged, increasing the power of the engines from 20 to 80, 160, 200, and 250 horses, it became possible to extend the field of their employment—to venture on the sea with them. Towing boats, which had been constructed in a few ports, soon threw a light on the superiority of the new system, by bringing out large vessels, weather-bound and condemned to inactivity, and drawing them in their wake with a facility which seemed to defy the elements. From that time the bright days of sail-navigation, which till then was looked upon as the *chef-d'œuvre* of human understanding, were eclipsed. Now, vessels were started on every coast; regular and rapid communications linked together every important town, such as Havre, London, Dover, Hamburgh, Rotterdam. This was the forerunner of more daring attempts.

In 1819, a vessel from the United States, the Savannah, had crossed the ocean from Liverpool to New-York, partly by wind and partly by steam. America, then, had the lead again in daring to apply Fulton's machine to long voyages; and this is the more remarkable, that it has always had but few steam-boats on sea service. This first essay was not repeated until, in 1835, when the English undertook the passage from Falmouth to the Cape of Good Hope: the Atalante, provided with an engine nearly similar to that of the Savannah, accomplished in 37 days a distance of 2400 nautical miles. The Berenice, the Medea, the Zenobia, performed passages of different lengths on the coast of

Africa and in the Indian seas. All these boats were English. In the Mediterranean, steamers of different nations—Neapolitan, Sardinian, Austrian, French—crossed from one port to another. Lastly, our service of steam packets from Marseilles to Alexandria was established, and threw open to us a new access to the East. The passage to Constantinople, which was sometimes 45 days in duration, was thus reduced to 13½ days.

These numerous experiments gave rise to the idea that, by the aid of steam, it was possible to accomplish the distance between Europe and the United States. The difficulty of carrying the necessary quantity of coals for the consumption of an engine acting without interruption from one shore of the ocean to the other, during a space of from 15 to 20 days, was no longer an obstacle. It had been discovered that the consumption of combustible did not increase in the same ratio with the power of the movers; that an engine of 250 horse power, for instance, was far from burning twice as much fuel as was necessary for an engine of 125 horse power; that, moreover, certain parts of the mechanism might be simplified in such a manner as to take up less room, and, consequently, leave more space at disposal for the accommodation of passengers or merchandize. From this time operations were commenced, and on the 4th of April, 1838, the first experiment was tried. You are all acquainted, gentlemen, with the result. You all beheld the enthusiasm excited by the success of the voyage undertaken by the Sirius: 15 days had been sufficient for its passage. Scarcely had this vessel arrived in the port of New-York, when it was joined by the Great Western, which started from Bristol on the 8th of the same month, after a passage of 14 days.*

Henceforth the problem was solved. America was nearer the European continent by half the distance which formerly separated them. There could be no more doubt concerning it. The events which have since occurred have ratified these first expectations.

The Great Western has crossed the Atlantic 28 times during the period of the 14 months just elapsed, without accident, maintaining an almost uniform speed, of which the average time was 16 days going, and 13 to 14 days coming back; the last voyage was even accomplished in 11½ days.

We have entered into these details, gentlemen, in order to show by what successive steps, and at what pains, these great results have been obtained. Their very tardiness is a pledge and a proof of their stability. This is no new idea; but a project, the execution of which has been sought after for the last 30 years. The human understanding has proceeded in this circumstance as it always proceeds in inventions of a durable nature—by uncertain attempts. Fulton's machine received, little by little, at the hands of its constructors those improvements which

* The length of this boat is 236 feet, its depth 23 feet 3 inches, its width outside the paddle-boxes 58 feet 4 inches, draught corresponding to the load 16 feet, tonnage 1340 tons. The engines are so constructed as to diminish the consumption of steam and fuel. It is said that they consume 33 tons of coal a day. The total cost of the vessel when it was launched was £55,000: since that time improvements have been effected in it which have amounted to £15,000. It carries 700 tons of goods and 135 passengers. The rest represents the weight of the engine, the boilers, and the water

time and experience are sure to occasion. Now the end is attained. The facts are undeniable; they have taken place in broad day-light. Let us now look into the consequences.

This is an event of no ordinary character, gentlemen—this approximation of the two worlds, and this new instrument delivered into the hands of maritime powers. An uninterrupted chain of communication established among numerous nations, until then divided by enormous distances, brings forward new relations among them. The flux and reflux of these nations towards one another increase the sphere of action of each. It is more than a revolution of commerce and industry; for when two individuals are brought together, their contact, the conjuncture of their efforts and of their minds, changes entirely the reciprocal conditions of their isolated state; when two nations, then, are brought into closer communication, the effect increases in the proportion of one man to the whole society. Nor can France, accustomed to serve as a medium and link between Europe and the United States, and who owes to her fortunate situation between three immense seas the advantage of beholding travelers from one continent to the other flock to her shores, remain unmoved, and in some sort indifferent, in the presence of such an event.

In these days, thanks to publicity, no secrets are hid in the industrial world. No sooner is a discovery made than it immediately becomes the property of every one. Every country may reap its advantages. If this discovery be important; if it be destined to introduce radical changes in the relative conditions of the power and influence of nations, each must adopt it, or run the risk of dwindling into an inferiority and impotence which will prove in the end the source of bitter regret; for, if we have remained stationary, if we have not increased in the same degree with our competitors in influence and wealth, we lose the power of interfering, with dignity, in the destinies of the world, and of adding our weight to the balance of important interests discussed in it. Steam is in the same predicament as gunpowder, printing, the compass, and the telegraph: every nation will adopt it, because all, out of self-preservation, must do what others further advanced in civilization have done. Wo to those who should not understand this necessity. There have been at long intervals periods when the genius of man has in this manner changed the conditions of labor and wealth. It was dearly paid by those nations who did not acknowledge and receive the new facts which the effects of science had disclosed. Why has Venice lost that ascendancy on the sea which she had enjoyed during four or five centuries, if it was not that the discovery of the Cape of Good Hope having thrown open regions until then unknown to commerce, she remained an inactive spectator of this revolution? Why have two great nations, Spain and Portugal, who were indebted to the genius of Columbus and of Vasco de Gama for their prosperity—why have they since fallen, if it be not that they slept on their riches, and left other nations to invade the openings they had made? In this continual and peaceable conflict of opposed interests, our weakness or our strength, our consideration or contempt, will depend on our understanding of the times, our appreciation or miscomprehension of the drift of events.

These are the motives, gentlemen, which have doubtless induced the

government to lay before you the projected law on which you are called upon to deliberate. It has felt that its duty was to hasten the development of steam navigation in France; that the interest of our commercial relations and our political influence commanded us to act, and to act immediately. A few words will sufficiently prove in what manner any delay would be fatal. You are aware that the principal branch of our external commerce is North America; that it participates to the amount of 133,000,000 in our importation, and 171,000,000 in our exportation. We exchange our wines, silks, &c. for the cotton, tobacco, &c. of the United States. Now, this great and fruitful source of our commercial prosperity is threatened. England is in advance of us: she has established, and is organizing at a considerable expense, lines of packets which bind all her old colonies, now emancipated, to their former metropolis, and to which they are still united by a similarity of blood, of language, and of origin. If we do not wish to be driven from these distant markets, we must do for the Atlantic what we have done in the Mediterranean.

During two years, since they began their operations, with what strides have the English advanced!

A first line from Bristol to New-York was established in 1838. The company to whom it belongs has four steamers of 450 horse power, namely, the Sirius, the Great Western, the William, and the Liverpool. The price of each of these boats is 1,300,000 francs. It is said that they now are building an iron steamer, which is to carry two engines, whose united powers will amount to 1000 horses. These engines are constructed on the plan of Mr. Humphreys: the boat will only be 100 meters in length, and will have room for 300 passengers, and a considerable quantity of merchandize. The works are in active continuation, and will be terminated, according to appearances, in the course of the year 1841.

Another line was established for the service of London and New-York. Two vessels were employed on it, the British Queen and the President. The engine of the British Queen is of 500 horse power; that of the President 600. They can accommodate from 225 to 250 passengers, and receive a load of from 500 to 600 tons. A third line connects New-York to Liverpool; so that there are already three establishments sending steam vessels from different parts of Great Britain to the United States.

Moreover, a contract was sealed on the 4th of July, 1839, between the Admiralty and Mr. Samuel Cunard, for the transit of letters from Liverpool to Halifax. Mr. Cunard has engaged that there shall be two departures per month, and receives from the government an annual remuneration of 1,500,000 francs. The Britannia, of 450 horse power, was launched in the beginning of February, 1839.

Lastly, a more extensive service will soon connect Great Britain with the West India islands. There is a company in existence under the name of the Royal Steam Navigation Company, which is preparing vessels for New Orleans, Mexico, and part of the South American coast. This Company the government indemnifies by an annual payment of 6,000,000 francs.

You must all perceive, gentlemen, that we must not delay entering

into the lists, for we are urged on by competition from every quarter, and the appearance of English steamers on every point of the new world, to the exclusion of our own, would soon banish us from those regions.

However serious the character of these motives, gentlemen, they are however secondary when compared to a consideration which we will not endeavor to conceal. The navy is a weapon, and one which, to all appearances, is destined to play an important part in the conflicts which a future day may bring to light. Attempting to foretell what consequences may be reserved for a future period by the introduction of steam in constructing ships of war, would be presumptuous: it is a question of entirely recent origin: experiments with regard to it are in their infancy. It is however already discernable that the use of new motors will infallibly produce the following effects:

In the first place, it will render every vessel in similar conditions equally supple and tractable, by whatever men she may be manned. It will be sufficient to have able engineers in order to effect manœuvres with a facility and precision as entirely independent of the state of the sea as of the greater or less aptitude of the sailors.

Secondly, the number and proportion of the men required for the performance of the ship's duty would be entirely changed. The Great Western, whose form and dimensions are nearly those of an ordinary frigate, is conducted by 50 men, including engineers and stokers. Now if it be true that the naval enrollment of France is incompetent to supply all her necessities, this inconvenience will vanish; and the more so, because the zone in which we shall be able to find men fit for the service will be extended.

Lastly, the draught of water required by a steamer depends upon its power; but, for all, it is less than that of ships of war. Whence it follows, that instead of the five or six ports to which our vessels and frigates can resort, steam-boats will be able to cast anchor off any coast, and, so to speak, in any bay.

Thus the new vessels, provided with a good engine, will be swift, will offer less hold to the enemy, will have a greater number of safe harbors to resort to, will require a less numerous crew and require less previous apprenticeship than in sailing vessels. This will evidently become a new weapon; and if these ships carry guns, for the discharge of bombs of a recent invention, whose effect is such that at one discharge they are capable of disabling the largest craft, they will become a weapon at once easy of management, safe, and of the most destructive nature. Is there not wherewithal here to change the whole direction of naval tactics, all the proportions existing between the powers of nations? Here is an entire revolution. Slow or fast, partial or complete, this revolution will ensue. Now, with the example given us by a government whose energetic endeavors are dedicated to the continued increase of its naval resources; when we see Great Britain during two years continually multiplying at the cost of such enormous sacrifices its steam navigation, and finding in the gigantic establishments of its industry those inexhaustible resources of which we are deprived, would it be wise, would it be prudent to continue our *materiel* in its present state, to abstain from making some progress in the new career which has been

traced out to us? Undoubtedly we do not indulge in the chimera that our country can ever equal the English in their naval establishment. The strength of the British nation rests entirely on its foreign trade: they are an exclusively seafaring nation. All the springs of its prosperity are there: it drags after it that colossal superiority which constitute at once its greatness and its peril. The conditions of existence in which France is situated are different; but the extent of its coast, its position, the genius of a portion of its inhabitants, compel it to possess a navy; and therefore it is fit that, wherever she may be pleased to hoist her flag, she may be enabled to assemble and display a sufficient force in order to insure respect. Without this she could never effectually protect her national interests beyond the seas.

The construction of steam-boats for trans-Atlantic voyages, presents, then, a double object to our view. Applied in time of peace to the growth and preservation of our commerce, they may be transformed during hostilities into ships of war: they may assume in turn the double character of a defensive weapon, and of a means of conveyance—of a commercial and of a military marine; to-day they may carry merchandize; and, when requisite, guns.

Thus, to conclude, two principal considerations have decided your commission to adopt with one consent the idea contained in this projected law: first, the necessity of preserving our foreign markets; secondly, of maintaining the established balance and equilibrium between the powers of England and France. United now by bonds of the closest friendship, neither of these great nations is desirous of renewing conflicts now extinguished. We devoutly wish that this happy concord, to which we owe the peace of the whole world, may continue; but, for its very duration, the position of both must be honorable; their union must not depend upon the decay of one, and the aggrandizement of the other, but on their equal and simultaneous development.

After thus explaining and justifying the grounds of the law, our next duty, gentlemen, is the examination of its details. The two first questions to be solved are these: Towards what points must our steam-boats be directed? and, From what ports must they set out?

[The Report then takes an elaborate view of the foreign commerce and relations of France, with which we need not trouble our readers, and concludes as follows.]

To what, then, does the question resolve itself? The construction of three steam-packets, the cost of which would amount to 5,000,000f. The lines of steam navigation will have this in common with railroads, that they will not only become subservient to existing relations, but will give rise to new ones. Such have everywhere been the consequences. Witness the steam-packets from Havre to Hamburgh, with which so many similar enterprises were connected: witness, again, the steamers on the Red Sea. The English East-India Company had for several years established a service of dispatches between Bombay and Suez, in order to accelerate its communication with Europe. But this service, up to 1838, was far from meeting every desire. The number of its steamers was not sufficient, a long interval succeeding between the days of departure, and travelers were frequently obliged to wait the uncertain passage of some vessel for Alexandria. The establishment of French steamers in the Mediterranean completely changed this state

of things. No sooner was our line in active operation than the English government immediately instituted measures to insure regular departures three times a month from India to Suez, so as to coincide with the arrival of our boats. The result is, that letters arrive in the space of 30 or 40 days, instead of three months time, which, before then, they required for the journey. Communications across the Atlantic will to all appearances occasion similar results. That the progress may be tardy, that the enterprise may remain for some time in suspense, we do not deny; but the political question to us seems to overbalance the pecuniary question.

Paddles versus *Screw-Propellers—Powers of the "Archimedes" and "William Gunston." In a Letter to the Editor of the London Mechanics' Magazine.*

Sir—In your 885th number I find it stated that the William Gunston towed the Archimedes astern against her own power, in which statement I see many errors; but as I intend to answer the inquiry of "H," contained in your 887th number, it is needless to advert to them, as answering the one corrects the other. That the William Gunston did tow the Archimedes astern against her own power, is a *fact, as I passed them at the time in the river*, and was so much surprised at the circumstance, that I took the trouble to inquire into their respective powers, and found that the two cylinders in the William Gunston are each 27 inches diameter, the length of stroke 42 inches, working pressure of steam 10 lbs., paddle-wheels 13 feet 4 inches in diameter, boards 7 feet 9 inches long, and 22 inches deep; vessel 20 feet beam. The Archimedes has two cylinders, 37 inches diameter, stroke 3 feet, with square boilers, working steam 6 lbs. on the inch. It will thus be seen, by comparing the relative areas of the cylinders of the Wm. Gunston and Archimedes, that the former is little more than one half the power of the latter. As to the horses power, the tug-boat is I believe called 50, the Archimedes 85: nevertheless, the William Gunston *did* tow the Archimedes astern, against the full operation of her screw-propeller, at a considerable speed.

In answer to your correspondent "M," in your 888th number, I beg to say, that though the above named trial may "prove satisfactorily that the screw-propeller has a valuable property, very necessary in swift-sailing vessels, which the paddle-wheel has not," (how comes it, then, that vessels with paddle-wheels run by the Archimedes, although she is in possession of the "swift-sailing" qualities?) yet I think it proves quite as satisfactorily that the screw would be of very little use to a vessel laboring against a heavy headwind and sea. I would ask, what sort of a figure one of the trans-Atlantic steamers would cut, with a screw in her stern, when met by such gales as the Great Western and the British Queen have contended with? Their "swift-sailing" qualities would be of little account then, I guess. Your correspondent further says, that "to assist in forming any idea of the powers of these two boats, they should have tried their speed in a race." This I can tell him was done, and that the William Gunston beat the Archimedes hollow.

I am, sir, your obedient servant, W. B.

MISCELLANEOUS.

Theory of the Daguerreotype Process. *By* **William E. A. Aikin**, *M.D. Professor of Chemistry and Pharmacy, University of Maryland.* [Communicated to the Maryland Medical and Surgical Journal for July, 1840.]

Some additional experiments upon this mysterious and interesting subject seem to give still greater probability to the theory suggested at the close of the article on the Daguerreotype in the last number of this Journal. The explanation of the process there hastily given, and which I have thought sufficiently probable to offer to my class, is simply as follows:

When the silver plate has been properly polished and exposed to the vapor of iodine, an iodide of silver is formed upon its surface. This iodide being exceedingly sensitive to light, is acted upon in the camera in a manner hitherto inexplicable, but the result of which is to render it decomposable by the vapor of mercury. Hence when the plate is transferred from the camera to the mercurial box, the coating of iodide of silver, altered by the light to which it has been exposed, is decomposed by the mercurial vapor, and two new products are obtained. One portion of mercury unites with the iodine, and forms an iodide of mercury, and another portion unites with the silver and forms an amalgam of silver. Lastly, the final washing of the plate removes all the newly-formed iodide of mercury, and leaves the amalgam of silver, which constitutes the picture. The difference of light and shade in the picture appears referable to a difference in the thickness of the deposit of amalgam of silver. This difference being again caused by the unequal action of light in the camera, those parts most brightly illuminated being subsequently more acted upon by the mercury than other parts that have been less illuminated. But there is one difficulty to be recollected. Is the whole of the iodide first formed on the plate finally decomposed by the mercurial vapor? Such can hardly be the case, since then there should be no difference in the quantity of amalgam formed on different parts of the plates, and we could not so well understand the production of light and shade in the picture. But if the first formed coating of iodide of silver is not at last wholly decomposed, how is the portion remaining unchanged protected from the further action of light? May the delicate film of amalgam on the whole surface of the picture act as a protection to any iodide of silver beneath the surface?

The experimental results which countenance the above view I will now briefly detail. First, in relation to the yellow coating formed on the silver plate by exposure to the vapor of iodine. That it is an iodide of silver, and not a mere mechanical deposit of iodine, may be made apparent. This coating is soluble in a solution of table salt; so is the acknowledged iodide of silver; and so, in lesser degree, is pure iodine. But the solution of iodine in that of table salt strikes a blue color at once, when brought in contact with a solution of starch. No such effect is produced when a solution of table salt containing the yellow coating, or

one containing the iodide of silver is used with the starch, for the simple reason that the iodine is in combination. Whereas, to produce the effect, it must be free. The addition of a drop of sulphuric acid, in the last two cases, gives at once the blue tint, in consequence of the decomposition of the iodide and the liberation of free iodine. It is well known that if the plate be kept too long exposed to the vapor of iodine, it acquires a purplish tint and becomes insensible to light in the camera. The same effect is produced by the incautious exposure of the properly prepared plate to light; hence the care required to seclude it from even the most feeble rays. I had thought at one time that such a condition of things might be produced, if we could suppose the film of iodide, formed by the first contact of the iodine vapor with the silver surface, to be afterwards covered with iodine in substance condensed upon it. And the same result observed after the undue exposure of the properly colored plate, I had supposed, might be owing to decomposition of a part or the whole of the iodide, leaving the dark-colored and free iodine visible. This supposed decomposition of the iodide of silver by light has been thought sufficient by some to explain the action of light on the plate in the camera, which would leave the silver in a pulverulent state, favorable to the action of the mercurial vapor. But no such supposition can be admitted, if my experiments are correct. A plate properly prepared was exposed freely to light, until the yellow tint had given place to a deep purple hue. The purple coat was then dissolved by a solution of table salt; but the resulting solution would give no indication of the presence of iodine until the addition of a drop of sulphuric acid. Hence the change in the color of the plate cannot be owing to the liberation of free iodine. Neither can we consider the effect of the action of light in the camera as the liberation of free iodine.

The action of light in the camera is quite inexplicable at present, and a long time may elapse before the secret is revealed. The very agent indispensable for the operations of the experimenter, the light necessary for his observations, may materially modify his results.

The action of the mercurial vapor appears somewhat more intelligible. As it has been proved that the iodide of silver is not decomposed by an exposure more than equal to that which is necessary in the camera, we cannot consider the mercurial vapor as simply uniting with a pulverulent deposit of metallic silver, supposed to be present on the plate. The silver is still in combination with iodine when the plate is placed in the mercurial box. The composition of the wash finally used shows the true action of the mercury. On evaporating a quantity of this, which had been several times used, and treating the dry residuum with nitric acid, again evaporating and dissolving the residuum in distilled water, I obtained a colorless liquid, which was subjected to the following reagents. A drop was placed upon the surface of a gold ring, and the point of a penknife made to touch the gold through the liquid. In the course of a few minutes the moistened gold, when viewed with a pocket lens, exhibited unequivocally the peculiar appearance caused by the action of metallic mercury upon its surface. The addition of muriatic acid, and at another time the addition of muriate of soda, did not at all disturb the transparency of the solution. Hence it must have contained a mercurial salt, but could not have contained any salt of silver. The

minutest quantity of the last would have been made visible as an insoluble chloride, by the last two reägents. The last washing then brings away a mercurial compound, but does not remove any of the silver, which accords with the changes I have supposed produced by the mercurial vapor. I did not think it necessary to search for the presence of iodine in the above liquid, since it must be present of necessity. Metallic mercury could not be dissolved in a solution of hyposulphite of soda, or of table salt, and we cannot possibly conceive of its combination in this case with any thing but iodine. We have to encounter here the same difficulty which I have mentioned as attending the supposed action of mercury on the prepared plate. If the mercurial vapor acts unequally, decomposing the iodide of silver more completely where it has been most fully exposed to light, and less completely where it has been less exposed, there must always be on every picture a portion of the iodide of silver left unchanged. If either of the solutions used for the final washing should come in contact with this iodide of silver, it would certainly be dissolved, and the proper reägents would then indicate the presence of silver in the wash. Such was not the case in my experiments; and the only inference left is that the iodide of silver, which is not decomposed when the plate is exposed to the mercurial vapor, is protected from the wash subsequently used by being covered with a delicate film of the insoluble amalgam of silver. Although the action of light upon the plate in the camera is certainly unequal, yet we cannot conceive that any portion of the surface is totally deprived of light. Hence there must be some mercurial action over the whole surface, greater or less, as indicated by the light and shade in the picture.

Lastly, in regard to the nature of the delicate film which constitutes the picture itself, I endeavored to satisfy myself by the following process: Dilute nitric acid was applied to the whole surface of a picture, and the reäction suffered to proceed until the picture itself, a portion of the silver surface beneath, and even a portion of the copper base was removed. From the resulting liquid the silver was thrown down as an insoluble chloride, by means of muriatic acid. The remaining solution was precipitated by a stream of sulphuretted hydrogen, and the resulting mixed sulphurets finally obtained in a dry state. I suppose them to be sulphurets of copper and mercury. To determine this, a few grains were introduced in a glass bulb, which communicated on one side by a bent quill tube with a wineglass of water, and on the other side by a straight tube, with an apparatus for liberating chlorine; the chlorine, before it was permitted to pass into the bulb, being made to pass through a tube containing fragments of recently ignited chloride of calcium, to free the gas from all traces of aqueous vapor. After the whole apparatus had been filled with chlorine, heat was applied to the sulphurets in the bulb, when there soon appeared a delicate crystalline crust in the opening of the tube connecting the bulb with the vessel of water. This portion of the tube was then removed by a file, and the adhering matter dissolved in distilled water, when the liquid on examination proved simply a dilute solution of corrosive sublimate. It whitened a gold surface, when applied in the manner detailed in another place. It gave a gray precipitate with the protomuriate of tin, and a yellowish orange precipi-

tate with a solution of caustic potassa: thus leaving no doubt as to its character.

These experiments, as detailed, constitute my reasons for adopting the theory of the Daguerreotype process, now given. As my sole object is the discovery of truth, I should be happy to have some more probable theory offered, if such can be suggested.

On the Preparation of Daguerreotype Plates.—The wonderful discovery of M. Daguerre of the mode of fixing the images of the camera obscura has induced many to repeat his experiments; some with the hope of simplifying the complicated and somewhat obscure processes by which he obtains his very interesting results. In the early part of last January I commenced a series of experiments, with a view to ascertain if better and cheaper plates could be made than those used by M. Daguerre. I am happy to say that my success has exceeded my most sanguine expectations.

The difficulty of procuring good plates, and their costliness, present the first obstacles. It being absolutely necessary to have a *perfectly pure* surface of silver to produce a good picture, the common plated sheet-copper used by the saddlers will not answer. The materials of the plates I now use can be easily procured any where, and at a trifling expense. The operator can make them himself in a very short time, for they neither require to be heated, nor the application of nitric acid, as directed by M. Daguerre, which abbreviates and simplifies the process very much. I use sheet-brass: copper is as good, if it be well planished, so as to make it very dense. The plate must be highly polished; first using fine pumice and oil, which gives a tolerably fine and regular surface, then rotten-stone and oil, which improves it considerably. You now cleanse it well by washing or wiping, when it must be finished very highly by the buff, with the peroxide of iron, without oil. The plate must be as bright as a mirror to produce a fine picture.

It is now ready for the silvering. Make a weak solution of the nitrate of silver, which must be applied equally over the surface of the brass with a camel's-hair brush. The silver is instantly precipitated, and adheres to the plate very firmly, in the form of a dark-brown powder. The surface should then be rubbed over gently with supertartrate of potash made moist with water, which restores it to its bright color. The successive application of the solution of the nitrate of silver and the supertartrate should be repeated at least three times. The solution of the nitrate should not be too strong, as it then corrodes the brass, and the silver will come off in flakes. The best criterion is to try the solution upon the edge of the plate. If it turns the plate *instantly* black, it is too strong. It should produce a deep-brown color, and that rather gradually. You now take another buff, (which should be used for no other purpose, and must be soft) and a little very fine peroxide of iron, and polish the plate finally as highly as possible. The buff should pass over the plate transversely, instead of circularly, as recommended by M. Daguerre, so that the marks it leaves should all run one way.

It is now ready for the iodine. The whole process is easily accomplished after a little practice. I could polish and silver the plate, and produce the picture in less time than it has taken to sketch this article.

When these plates are properly prepared, they are capable of producing the very finest specimens of Daguerreotype drawing. I have made a number of drawings with them, and some of them are the finest I have ever seen. I have been assisted in my labors by my friend Dr. Augustus Barnum, and embrace with pleasure this occasion to express my deep sensibility of his kindness, and my high estimation of his character.

THEODATUS GARLICK, M. D.

Baltimore, August 11th, 1840.

Meadow Leather.—An interesting vegetable production, having a deceptive resemblance to white-dressed glove-leather, has lately been found on a meadow above the wire-factory at Schwartzenberg, in the Erzgebirge. A green slimy substance grew on the surface of the stagnant waters in the meadow; which, the water being slowly let off, deposited itself on the grass, dried; became quite colorless, and might then be removed in large pieces. The outside of this natural production resembles soft, dressed glove-leather, or fine paper; is shining, smooth to the touch, and of the toughness of common printing (unsized) paper. On the inner side, which was in contact with the water, it has a lively green color, and we can still distinguish green leaves which have formed the leather-like pellicle. Dr. Ehrenberg has submitted this meadow leather to a microscopic examination, and has found it to consist most distinctly of *Conferva capillaris*, *Conferva punctalis*, and *Oscillatoria limosa*, forming together a compact felt, bleached by the sun on the upper surface, and including some fallen tree leaves and some blades of grass. Among these *Conferva* lie scattered a number of siliceous infusoria, chiefly *Fragilariæ* and *Meridion vernale*, including 16 different sorts belonging to 6 genera, besides three sorts of infusoria, with membranous shields and dried specimens of *Anguillula fluviatilis*. Phil. Mag.

Scales of the Eel.—Dr. Buckland has remarked to the Geological Section of the British Association on the fine provision in the external economy of the eel, covered with minute scales, and having diffused over them a quantity of slimy mucus, under which, being concealed, they are admirably adapted for that mode of life which consists of imbedding themselves in mud, or penetrating under stones and rock.

Description of an Improvement on Rutherford's Registering Thermometer, by Mr. John Dunn.—The maximum and minimum registering thermometers of Rutherford are not only the simplest, but by far the best yet invented; indeed, all that is required in their construction beyond an ordinary mercurial thermometer for the maximum, and a spirit-of-wine one for the minimum, is to place them horizontal, and introduce into each a small index—in the one to be pushed up by the mercury, and to be dragged down by the alcohol in the other. No difficulty has been felt in executing the minimum one so as to *act* with certainty: this is not the case, however, with the mercurial one; for it has been found that the glass enamel index used by Rutherford himself is drawn back by the mercury; and the same happens with various substances. The material usually employed, and which answers best, is steel: this, however, is often rendered useless by the mercury amalgamating with

it. Various fluids have been introduced to get the better of this; but all of these are liable to the objection of mixing with the mercury. After various unsatisfactory efforts, I at last found that, like the story of Columbus and the egg, it was the easiest thing in the world; for it so happens that, although mercury attracts glass and amalgamates with steel, there is (for our purpose) no attraction between glass and steel, and mercury does not amalgamate with glass: it is therefore only necessary to introduce or interpose betwixt the mercury and steel a small piece of glass, or second index, as is done in the thermometer on the table. Jameson's Phil. Jour.

On Pepsin—The principle of Digestion.—M. Wasmann has succeeded in isolating pepsin, the peculiar principle of the gastric juice, described by M. Schwann, in the following manner:

The glandular membrane of the stomach is to be separated without cutting it: it is to be washed and digested in distilled water at a temperature of 86° to 95° Fahrenheit: after some hours the liquid is to be poured off, the membrane is to be again similarly digested, and to be treated with cold water till it exhales a putrid odor: it is then to be filtered: the filtered liquor is transparent, slightly viscid, and exhibits a remarkable digestive power when a small quantity of hydrochloric acid is added to it. In order to extract the pepsin in a pure state, acetate of lead is to be added to this liquor; the precipitate is washed, diffused in water, and decomposed by a current of hydrosulphuric acid. The filtered liquor is colorless, and has an acid action, owing to the acetic acid.

When this liquor is evaporated at 95° Fahrenheit, to the consistence of a syrup, and absolute alcohol is added to it, an abundant flocculent precipitate is formed, which, on drying, leaves a yellow, gummy matter, which does not attract moisture, and is pure pepsin.

This substance easily dissolves in water; and the solution, even though it contains only 1-5000, dissolves slightly acidulated white of egg in about six or eight hours. The aqueous solution has an acid action, owing to some acetic acid which remains intimately combined with it: it cannot be separated from the pepsinate of lead, even by repeated washings. By ebullition, this liquor loses its digestive powers. If the free acid which it contains be cautiously saturated by potash, a small quantity only of which is requisite, flocculi are deposited, and the digestive power is also lost.

The alkalies cautiously added to the solution of pepsin, till the free acid is saturated, occasion the formation of flocculi, and the liquor has no acid action. Sulphuric acid in small quantity produces white flocculi, which re-dissolve in a slight excess of the acid: by the addition of a further quantity, fresh flocculi are produced: hydrochloric and nitric acids produce the same effects.

Perchloride of mercury occasions a precipitate which is re-dissolved by an excess of it: the protosulphate and persulphate of iron, and the sulphate of copper, precipitate pepsin. Alcohol precipitates it from a concentrated solution. According to M. Pappenheim, this precipitate dissolves in hydrochloric acid, and dissolves boiled white of egg. M. Wasmann confirms this statement of the digestive power of the precipi-

tate formed by alcohol, while, according to M. Schwann, alcohol destroys the digestive property of pepsin.

Pepsin is recognized by the precipitates which its solution gives with diluted acids, and which re-dissolve in an excess of the acids, and by its giving no precipitate with ferrocyanide of potassium. It is distinguished from albumen by the precipitates which its solution yields on the addition of water and hydrochloric acid; and from caseum, by its acid solutions yielding no precipitate with ferrocyanide of potassium.

Journal de Chimie Medicale, Aout, 1840.

Fire without Coals.—Sir: If there be anything to render impracticable the following simple though important scheme by which the metropolis would save upwards of a million sterling per annum, no doubt it will be seen, by some of the numerous and enlightened readers of your excellent and extensively circulated periodical. Instead of having coals brought to London, for which we pay more than £150 a ship freight and lighterage, I would suggest, that the railroads to the coal countries be made available, for the conveyance of gas, prepared near the pit's mouth, and by the pressure of the gasometers sent through pipes attached to the line into gasometers in the vicinity of London, thence to its destination, for lighting and heating; thus causing a reduction in the price of gas, that would bring it to nine pence instead of nine shillings, which is the lowest present price per thousand cubical feet. This would not only be the means of effecting the above saving of expense, but it would abolish the nuisance of gas-houses about the metropolis, "a consummation devoutly to be wished;" it would annihilate the London smoke; it would cause the river to be more clear, and less dangerous for navigation; instead of black and smoky fire-places in drawing rooms, &c. an elegant ornament, as an urn, or a vase, may be substituted, containing twenty or thirty jets, each emitting a brilliant and cheering blaze, and all combining to make one bright and smokeless fire, in the form of a flower, or some tasteful device, according to fancy's dictate, easily regulated at pleasure, and answering to the simple turning of a cock. And when gas shall become as cheap as water, which soon may be expected, all the business of manufactories and steam engines may be done with it, which will obviate the necessity for importing any coals at all.

I am, sir, your obedient servant, AN ECONOMIZER.

[Professor Aldini, of Florence, when in England many years ago, proposed a plan of nearly the same sort.—*Ed. Mec. Mag.*] Mech. Mag.

To make Linen fire-proof.—A correspondent wishes to know how linen may be rendered incombustible by simple immersion and drying. Perhaps the cheapest and simplest mode is to dip the linen into a solution of equal parts of alum and borax, combined with a little common starch. Linen thus prepared will not flame. The water of crystallization in the alum protects the fabric at a low heat, and at a higher temperature the borax comes into action. Mechanics' Mag.

The Archimedes Patent Screw-Propeller Ship.—This vessel made the voyage from Plymouth to Oporto in 70 hours; and on Wednesday morning intelligence was received of her return from Oporto to Ply-

mouth in 88 hours; total out and home 158 hours, the most part of which was performed against strong headwinds and a heavy sea. This is unquestionably the most successful voyage ever made by a steam vessel, the efficient working power of which has been ascertained not to exceed 65 horses; and, we imagine, there can no longer be any question as to the superiority of patent screw-propellers as compared with paddle-wheels. Sun.

The conclusion of our contemporary is wholly unwarranted by his premises. The total distance performed was only about 1600 miles, the average per hour little more than 10; a rate of speed which has been times out of number far exceeded by paddle-wheel steamers, and indeed even by sailing vessels. That the adoption of the screw propeller may, under many circumstances, be attended with great advantage, there can be no doubt; but that it is superior to the paddle-wheel has never yet been proved, and we do not believe can be proved. Mec. Mag.

Launch of two Iron Steamers.—Saturday, August 17th, two wrought iron steam vessels were launched from the yard of Messrs. Ditchburn & Mare, Blackwall—an occurrence, we believe, never before witnessed on the Thames: one was named the Swallow, intended for the Baltic, the other the Elberfeld, for the Rhine. Messrs. Penn & Son, of Greenwich, are the engineers for the former; Messrs. Miller & Ravenhill, Blackwall, for the latter. The engines in both vessels are oscillating. Mech. Mag.

Pottery Printing.—Considerable sensation has been excited among the engravers in the potteries, by experiments that are now being made by a gentleman from London, in transferring designs and patterns from lithographic prints to earthenware. Apprehensions are entertained that it will supersede engraving altogether. The effect is exceedingly beautiful. English paper.

Antiseptic qualities of Peat.—A murder, committed nearly thirty years ago, has been discovered in the county of Donegal, Ireland, owing to the well known antiseptic properties of peat. It appears, from the statement in a Derry paper, that some men who were cutting turf in Ballikinard bog, on the 21st of August, discovered the body of a female in a state of the most perfect preservation, the flesh not in the least decayed or shriveled, but perfectly free from all unpleasant smell. The woman had evidently been murdered, as her throat was cut, the hair and a riband encircling the head stained with blood, and the left arm broken. An inquest was held on the body, when several witnesses stated that they distinctly recognized the body as that of Betty Thompson, wife of Owen McSmine, deceased, who suddenly disappeared in the month of May, 1811, under circumstances of a most suspicious nature. It had always been rumored in the neighborhood, from the time she had been missed, that the body had been buried in the bog, after she had been murdered (as was generally supposed) by the parties suspected; though strange to say, no search was made, nor did any investigation ever take place, until the body was accidentally discovered near the surface of the bog. The features of the woman had apparently undergone not the least change by time, and even her clothes were

uninjured. The jury found—"That the body was the body of Betty Thompson, who disappeared in the month of May, 1811; and that she came to her death in consequence of a wound inflicted on her throat with some sharp instrument, by some person or persons unknown."

DESCRIPTION OF AMERICAN PATENTS

Granted from Sept. 14th to Oct. 14th, 1840.

Improvement in the Machine for cutting Staves, &c. By CEPHAS MANNING, Acton, Mass. Sept. 14th.

CLAIM.—I claim the arrangement of knives attached to the revolving shaft, in combination with the arrangement of machinery for moving forward the carriage as the staves are cut, in the manner described.

Improvement in the Horse-Power for driving Machinery. By CHARLES HIBBARD, Guilford, N. H. Sept. 14th.

CLAIM.—I claim as my invention turning the shaft A, by means of the long band E E, passing around pulleys D K, to which band a horse or horses are attached; the whole being arranged and operating substantially in the manner and for the purposes herein above described.

Improvement in two-wheeled Carriages. By JOHN PAGE, New-York. Sept. 9th. Antedated Aug. 12th, 1840.

CLAIM.—What I claim therein, and desire to secure by letters patent, is the manner in which I have combined and arranged the bent axle, the shafts, the springs, and the body of the cab or carriage, with each other, the bent axle being carried either in the front of or behind the body, as herein set forth. I also claim, in combination therewith, the manner in which I have arranged the seats and the door, by placing the former in opposite corners, and the latter on one side, as set forth, by which arrangement two persons may be conveniently seated in a smaller space than could be accomplished under any other arrangement.

Improvement in Keybands for Tobacco Casks. By JAMES M. TALBOT, Richmond, Va. Sept. 14th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is constructing the keyband with a mortise plate C, in combination with the tongue T, and wedge K; the whole being constructed substantially as herein set forth.

Improvement in Machines for extracting Stumps. By LEWIS and CHAS. HOWARD, Reading, Steuben co., N. Y. Sept. 14th.

CLAIM.—What we claim as our invention, and desire to secure by letters patent, is the manner in which we have arranged A A, C C, D D, in connection with the frame of the machine, and their farther combination with the hands E E, wheels F F, anchor T T, and chain Y, for extracting the stumps, &c.—all as herein described.

Improvement in the Floating Dry Dock, for raising and removing Vessels. By JOHN S. GILBERT, New-York. Sept. 19th.

CLAIM.—Having thus fully described the manner in which I construct my floating balance, and of the mode of using the same, I do hereby declare that what I claim therein as my invention, and desire to secure by letters patent, is the combination of the body of the dock in which a ship can float with water-tight trunks or tanks at the sides separated by water-tight bulks, for the purpose and in the manner specified.

Improvement in Cooking Stoves. By JAMES STILL, Zanesville, Ohio. Sept. 19th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is :—

1. The mode of furnishing a double draft by extending the top-plate of the oven back, so as to divide the collar D, to which the smoke-pipe is attached, into two parts, for the purpose of allowing a draft above and below the oven at the same time, as above described.

2. In constructing a flue under the oven with an opening at its bottom, and adapting thereto a moveable ash-box, as set forth.

Improvement in Machines for cleaning Grain, &c. By EDWARD BRADFIELD, Rochester, N. Y. Sept. 19th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is constructing the revolving cylinder with elastic teeth, as herein set forth; also, in combination with the above, the revolving radial plate at the bottom of the machine, in which is combined their self-regulating power, so as to effect the greatest possible good for the purpose intended, as herein set forth.

Improvements in the manner of constructing Mills for grinding Coffee, &c. By LAWRESTON R. LIVINGSTON and CALVIN ADAMS, Pittsburgh, Pa. Sept. 25th.

CLAIM.—What we claim therein as constituting our invention, is :—

1. The manner of combining the hopper, the shell, and the arch pieces and collar, as herein set forth, so as to form the whole in one piece of casting.

2. The manner of fastening the mill to a table or shelf, by means of the hook and nut, and the projecting plate cast with the hopper, as described.

3. The manner of regulating the nut so as to grind either coarse or fine, by means of a screw and nut regulating the bearing of the socket of the handle upon the face of the collar, or by means of a screw passing through the head of said handle, and bearing upon the collar, substantially in the manner herein set forth.

Improvement in the manner of constructing Locks for Doors. By PETER ROGERS, Philadelphia, Pa. Sept. 25th.

CLAIM.—What I claim as constituting my invention therein, and desire to secure by letters patent, is the constructing, combining and arranging of the socket *c c*, the inner faller *d d*, and the inner knob *b'*, in the manner and for the purpose herein set forth, so that the two knobs may act

independently of each other. I do not claim the mere making of the inner knob to act upon the spring-bolt independently of the outer knob, this having been done in other modes, but I limit my claim to the effecting this object substantially in the manner herein made known.

Improvements in the self-acting Mule for Spinning. By DANIEL P. LAPHAM, administrator of BENJAMIN LAPHAM, Adams, Mass. Sept. 25th.

CLAIM.—What I claim as my improvements are, the arrangement of means, as herein substantially set forth, by which the back faller and guide-wire *h*, 5, is made to operate on the lower guide-bar *l*, 6, and through that and the shaft *a*, 6, on the friction plates Y, and *y*, 1, to regulate the tension of the threads when winding.

I further claim the arrangement of means described, by which the shaft *v*, the pinion *w*, the cam *d*, 5, lever *d*, 6, crank 11, and finger 12, depressing the roller in 9, and sliding bar *m* 4, in combination with the motion of the cams *g*, 3, *g*, 4, and upper guide-bar *h*, 1, operates on the top faller and guide-wire *m*, 3, to produce a cop, built in successive commencements, in such a way that the cop will unwind without loss by tangling or waste.

Finally, I claim the general construction of new parts, claimed as above as invented and applied by me, to and with the parts of common spinning machines which are retained, as above described and set forth, for the purposes of maintaining an equal tension of the threads when winding, and building cops which will unwind without loss by tangling or waste, as the same are herein substantially described and set forth, including any mechanical variations in the position of the parts which shall be substantially the same in the means employed and the effects produced.

Improvement in Presses for Cotton, Hay, &c. By JAMES A. POTTER, Providence, R. I., and ISAAC E. KELSEY, Poughkeepsie, N. Y. Sept. 25th.

CLAIM.—What we claim as our invention, and desire to secure by letters patent, is the employment of two revolving, endless-chain platforms, so constructed as that they shall be nearer together at one end than they are at the other, in order that a bale or other article passed between them shall be reduced in thickness; said platforms being adjustible, and otherwise formed and operating substantially in the manner herein set forth.

Improvement in the Cot or Cross Bedstead Sofa. By GERARD SICKELS, Middletown, Ct. Sept. 25th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the art, principle or contrivance of converting a common cot or cross bedstead into the shape of a sofa or settee, and *vice versâ*, by means of an additional joint in the upper part of one of the cross stanchions or legs at each end of the cot, combined with arms and frontispieces—all constructed, fitted and adapted to each other, in the manner herein before specified and described, for the purpose of producing, and thereby producing at pleasure, from the common cot or

cross bedstead, a cheap and firm sofa or settee, having an elastic back and seat simply by the use of the sack bottom, in the manner herein before described; which sofa or settee is again convertible at pleasure into the form of a cot bedstead, and so from the one form to the other, as occasion may require.

Improvements in the construction of the self-acting Mule for Spinning. By WILLIAM MASON, Taunton, Mass. Oct. 8th.

CLAIM.—Having thus fully described the construction of my self-acting mule, and shown the manner in which it operates, I claim as my invention, and desire to secure by letters patent, the running of the carriage out and in, by means of endless gearing chains, the revolution of which is not reversed, but continues in the same direction, whether the carriage is running out or in; the carriage being connected to said chains by means of arms or sweeps, working upon studs attached to the chains, substantially as described.

I claim the manner of governing the action of the friction plate and pulley upon each other, by the combined operation of the steel tubes 35, the axis 34, and the wires *q*, *q*, arranged and operated upon as described.

I claim the general arrangement of the apparatus for reversing the motion of the plate pulley, and the respective pulleys over which its band passes, by the action of the pinion 17, or the hub of the pulley E, said pinion producing this effect through the intermedium of the train of wheels numbered 18, 19, 20, 14, 21 and 22, or by any combination and arrangement of wheels similar in their arrangement, operation, and effect. In the combination of the wheel-work employed for reversing the motion of the plate pulley and its appendages, I employ the planet motion, consisting of the wheels 13, 14, 15 and 16; but I do not make any claim to this combination of wheels taken independently of the parts with which they are immediately connected in my machine—a similar combination of wheels being well known to, and frequently used by machinists, under the denomination of the differential motion. I claim their employment, therefore, in combination with the other gearing, as described, and with which they coöperate in effecting the reversing motion.

And it is also to be understood that I do not mean to limit myself to this means of producing the said reverse motion of the friction plate, as the same may be accomplished by other kinds of gearing; but I have adopted and described that which I consider the best in its operation.

I claim the manner of constructing the shaper with the hooked joint piece o^3 at its outer end, in combination with the ratchet, the latch, and its other appendages, by which its inclination is altered, and by which it is held in its place and liberated, as set forth.

I claim the manner in which I have combined and connected the catch-wheel contained in the pulley V, with the catch-wheel, the pinions 24 and 25, and the segment wheel 26, so as to cause it to turn the faller down, through the intervention of the parts concerned in producing that effect, constructed as described.

I claim the manner in which I have constructed, arranged and combined the lever C′ with the cam B′, so as regularly to alter the inclina-

tion of the shaper, to regulate the backing off as the cops fill, and to graduate the turning down of the faller, as herein fully described.

I claim, in combination with the self-acting mule, as described, the manner in which I have arranged and combined the pulleys B, C, D, and E, so as to be acted upon in succession by the same belt, and by which arrangement the striking in of catches or other similar devices, usually employed in actuating the rollers and carriage, are entirely dispensed with, and a smooth and easy transition is secured.

Improvement in Pianofortes. By JESSE CHICKERING, Boston, Mass. Oct. 8th.

CLAIM.—Having thus described my improvements, I shall claim as my invention, attaching or combining the bridge (over which the strings pass to the straining pins) and also the socket through which the damper wires pass, to and with the iron frame, by casting them thereon, or solid in one and the same piece with the frame, the whole arrangement being substantially in the manner and for the purposes herein set forth.

Improvement in Machines for hulling Rice. By WILLIAM C. GRIMES, York, Pa. Oct. 8th.

CLAIM.—What I claim as new and as my invention, and desire to secure by letters patent, is the mode of hulling rice, seed or grain by means of the combined action of a rapidly revolving hollow cylinder, and one or more smaller cylinders, armed with pins, teeth or projections revolving upon a fixed axis, and operating as set forth, it being eccentric with and within the former, where the hulling and scouring is effected, the said projections acting upon the rice or seed while it densely lines by centrifugal force the inner surface of the hollow cylinder, as before specified. I claim the application of centrifugal force to the purposes applied, in the manner set forth.

Improvement in the manufacture of White Lead. By HORACE COREY, England. Oct. 8th.

CLAIM.—What I claim as my invention is, first, the combining of the process of making white lead with the process of making lime, whereby the carbonic acid gas evolved in the latter process is beneficially applied, in place of permitting it to pass into the atmosphere; and secondly, I claim the mode of submitting suitable solutions of lead to the action of carbonic acid gas, as above described.

Improvement in the mode of evaporating solutions, decoctions, &c. and preparing medical extracts. By JAMES W. W. GORDON, Baltimore, Md. Oct. 8th.

CLAIM.—What I claim therein, and desire to secure by letters patent, is the employment of a revolving table, constructed and operating substantially in the manner of that herein described, for the evaporating of decoctions, infusions or solutions, and the producing of pharmaceutical extracts without artificial heat, as fully described and made known in the foregoing specification thereof.

Improvement in the Flyer for twisting Silk, &c. By EDWARD L. YOUNG, Norfolk, Va. Oct. 8th.

CLAIM.—For this my method of counteracting the centrifugal tendency of the flyer, at the same time bracing the flyers or supporters of the side and end guides, I claim as my invention, and desire to secure the same by letters patent.

Improvement in the mode of raising and lowering Venetian Blinds. By JOHN WEIR, New-York city. Oct. 8th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the mode of raising and lowering Venetian blinds, and retaining them at any height, without the operation of fixing the cords by means of the combination of the blinds, cords passing through the slats, the roller, the band on the end of the roller, and the cord passing around the same, and the ratchet-wheel and catch, all as herein described.

Improvement in Railway Tracks. By BENJAMIN H. LATROBE, Baltimore, Md. Oct. 8th.

CLAIM.—I claim the form of rail herein described, in combination with a wooden stringpiece to give it stiffness against lateral disturbance, the upper table of the rail having a continuous bearing on the stringpiece, and the lower table a support at intervals on the cross ties. I claim the mode of fastening the rail to the inner side of the stringpiece by horizontal bolts and nuts as herein described, or by spikes in place of bolts and nuts, or by bolts and keys or cottars in combination with said rail.

Manufacture of Clŏth of various kinds, by the employment of Wool and Silk obtained by reducing worn-out Woolen and Silk Goods into the fibrous state. By REUBEN DANIELS, Woodstock, Vt. Oct. 8th.

CLAIM.—What I claim as my invention or discovery, and desire to secure by letters patent, is the employment of wool and of silk obtained by the reducing into the fibrous state of worn-out woolen or silk goods, so as to produce new fabrics, by the operation of spinning and weaving, equal in all respects to those obtained from new or fresh wool; said re-produced fibre to be used either alone, or in a proportion to that of the fresh wool of not less than one-sixth part.

Improvement in Fire-Arms. By SILAS DAY, New-York city. Oct. 8th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the curved chamber, and in combination therewith the sliding valve H, and its appendages, consisting of the slot L, and lever D, for the purpose and in the manner herein described.

Improvement in the Machine for cutting the Teeth of Combs. By JOSEPH S. IVES, Bristol, Ct. Oct. 8th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the pressing the tooth while cutting against the side of the saw, in the manner and for the purpose herein above described, by which means I am enabled to cut the teeth very thin, and cut them straight.

Improvement in the manner of constructing Locomotive and other Railroad Carriages. By Alfred C. Jones, Philadelphia, Pa. Oct. 10th.

Claim.—What I claim as my invention in that part of my improvement which I have denominated the *Railroad Regulator*, is the manner in which I have applied the principle of transferring a portion of the weight of the carriage or load from one wheel to another, so as to increase the pressure upon the wheel which may be upon an unduly elevated part of the rail, and to decrease it on that which may be in a hollow or depression. For the manner of carrying out this principle, I refer to the foregoing exemplification thereof, claiming the same as set forth, together with such variations thereof as are substantially similar.

Machine for reducing worn-out Cloths and Silks of various kinds to the fibrous state, so as to be capable of being manufactured into Cloth. By Reuben Daniels, Woodstock, Vt. Oct. 10th.

Claim.—Having thus fully described the manner in which I construct my machine for reducing woolen rags, and also worn-out silks, into fibrous stock, fit to be re-manufactured, it is to be understood that I do not claim the mere use of cylinders furnished with teeth or points, for the purpose of tearing or reducing woolen or other rags into fibres; but what I do claim as constituting my invention, and desire to secure by letters patent, is the use of cylinders furnished with teeth or points, and operating under water or other fluid, in a machine similar in its general form to that used by paper-makers in preparing their pulp, but combined with the concave of small cylinders E E, and operating substantially in the manner of that herein fully described and made known.

Improvement in Cooking Stoves. By R. G. Cochran, Francistown, N.H. Oct. 10th.

Claim.—What I claim as constituting my invention, and desire to secure by letters patent, is the manner in which I have combined and arranged the air-chest for heating air, with a cooking stove, rendering the oven or ovens of such stoves auxiliary thereto, by converting them into air-heating chambers, and connecting them with the air-chamber first named, in the manner and for the purpose herein set forth; the whole apparatus being constructed and operating substantially as described, with such variations only as may be rendered expedient by the particular construction of the stove used.

Improvement in the mode of working and pressing Butter. By Titus D. Gail, Eden, Erie co. N. Y. Oct. 10th.

Claim.—What I claim as my invention, and desire to secure by letters patent, is the combination of the horizontal pistons D D, working within the side-boards C C, and operated by the levers G G, as herein set forth; and also the vertical block or piston X attached to and operated by the lever L; likewise the table A A, constructed with boxes B B, all as above described; and in combination with the foregoing, the box or mould pistons S S, and the side O, for the purpose herein set forth.

Improvement in the Machine for cutting Screws upon the ends of the Rails of Bedsteads. By Jacob Lindly, Cynthiana, Ky. Oct. 10th.

Claim.—What I claim therein, and desire to secure by letters patent, is the manner of forming the cutters for cutting the screws on the ends of the rails, by making them a part of and one with the sockets or female screws D, D′. I also claim the manner in which I have combined and arranged these sockets, the screw shafts, and the standard, with each other, for the purpose set forth.

Improvement in Machines for pricking Leather preparatory to stitching, entitled the Thorough-Brace Pricker. By Samuel Sheldon, Cincinnati, Ohio. Oct. 10th.

Claim.—What I claim therein as new, and desire to secure by letters patent, is the arrangement for regulating the feed by which the clamp is moved, and the distances of the stitches governed; that is to say, I claim the mode of combining the awl-slide, the strap S, the slide T, and its pin *t*, and the weight V, as described; and in combination therewith, I claim the auxiliary means of regulating the feed by means of the pitman E, combined with the pitman wheel D, and the strap S, connected with the other parts of the operation, as herein set forth.

Improvement in Machines for pricking Leather preparatory to stitching, entitled the Brace and Harness Pricker. By Samuel Sheldon, Cincinnati, Ohio. Oct. 10th.

Claim.—What I claim as new therein, and desire to secure by letters patent, is:—1. The manner in which I have combined and arranged the apparatus for moving the awl back and forth, as herein described; said combination consisting of the strap shaft, with the strap attached thereto, and the pinion thereon, taking into the rack on the awl-shaft; the metal rods *a* and *b*, and the spring R, substituted for the leather strap and the spring in my former patent; the respective parts being arranged and coöperating substantially in the manner and for the purpose herein fully set forth.—2. I claim the manner in which I have combined the screws and swivel nuts, with the clamp for holding the strap, as herein described.

Improvement in the mode of supplying Steam Boilers with Water. By Benjamin M. Hyatt, Wilmington, Del. Oct. 10th.

Claim.—I do not therefore claim the raising of water by the condensation of steam in a vessel for that purpose; but what I do claim, is the combination for raising water, and supplying a steam boiler therewith, as herein set forth; that is to say, by the use of the pipes B and C, leading from the cylinder A into the boiler, combined with the respective stopcocks connected with the cylinder A and the boiler, said cocks being operated by the stroke of the steam-engine in any convenient way, so as to allow the steam in the cistern at every stroke of the piston to come in contact with the tube D, so as to produce a rapid condensation, and a consequent vacuum for the admission of water from the supply reservoir.

I also claim the combination and arrangement as above set forth, for

supplying water to the boiler from the cistern F, or from any sufficient source above the boiler, the combination and the action of the respective cocks by the power of the engine, being in all respects as herein set forth, with the exception of the apparatus for raising the water from a well or reservoir below the boiler.

I wish to be understood also as not claiming in this the raising of water into a cistern connected with a steam-boiler by atmospheric pressure, steam being admitted from the boiler into the cistern and condensed, as in my arrangement, unless the mode of supplying the boiler from the cistern by balancing the pressure of the steam be employed as herein described.

Improvement in the manner of propelling Boats upon Canals or other shoal water by the agency of Steam. By MELLEN BATTEL, Albany, N. Y. Oct. 14th.

CLAIM.—What I claim as constituting my invention, and desire to secure by letters patent, is the manner in which I have constructed, combined and arranged the respective parts by which the propelling is effected; that is to say, I claim the forming of the combined ground and paddle-wheel, so as to run upon the bottom of the canal, and to propel the boat by the hold or friction of the cross-bars and the rims alone, and when raised from the bottom, to effect the propelling by the buckets or paddles; said wheels being connected and combined with a vibrating frame within the body of the boat, which frame also sustains the steam cylinders in the manner set forth, and the respective parts concerned in the operation of propelling being arranged and operating substantially in the manner herein described.

Improvement in Cooking Stoves for burning Bituminous Coal, &c. consisting of a mode of cleaning the Flues surrounding the Ovens of the same, &c. By WM. B. LAWRENCE, Cincinnati, Ohio. Oct. 14th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the manner herein described of cleaning the flues surrounding the ovens of stoves of various kinds, by the use of a scraper, cast or otherwise made in one piece, so as to surround the oven on four sides; and in combination therewith, I claim the respective openings in the bottom plate leading into the drawer or receptacle for the soot and ashes, the whole being constructed substantially in the manner herein set forth; and these I claim, whatever variation of form they may undergo, whilst the same result is produced by means substantially the same.

Improvement in Spark Arresters. By RANDAL FISH, New-York. Oct. 14th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the construction of cylinders or drums in the pipe or chimney of locomotive stoves, and in the manner herein set forth, viz. by constucting said cylinders or drums with a reservoir at the bottom, and dividing them into separate vertical divisions or partitions, and conducting the draft through an opening in the vertical pipe into one of said divisions, thence by means of separate pipes connecting one division

with the other alternately into each division, and then into the vertical pipe *n n n*, through an opening in the upper extremity of said pipe, between which and the lower extremity there is a partition; the whole being constructed, arranged and operating as herein set forth. It is obvious that the form and size of the apparatus, or the parts of it, may be indifferently varied; but I claim all such variation of the same as may be substantially the same in principle: in some cases one drum or chamber is sufficient, without a division of the cylinder.

Improvement in the manner of constructing Wheels for Railroad Cars. By ALBERT FULLER, Providence, R. I. Oct. 14th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is placing the tire *a a*, in the sink *d e f*, in combination with the cast-iron chilled flange *b*, for the purpose and in the manner described.

Improvement in Vegetable Cutters. By GEORGE J. NEVEIL, Rising Sun, Pa. Oct. 14th.

CLAIM.—What I do claim as my invention, and which I desire to secure by letters patent, consists in the before described mode of constructing the hollow truncated cone of cutters, for cutting vegetables, roots, &c. namely, by means of the open and solid head, grooved on the faces toward each other, to admit the ends of the segments and knives, and held together by rods and screws, arranged in such manner that they can be loosened at pleasure for the purpose of setting the segments nearer to or farther from the cutting edges of the knives, for the purpose of cutting coarser or finer, and again tightened, to hold them securely in the position in which they are set, all as herein set forth.

Improvement in the mode of making Hats buoyant, so that they can be used as Life-Preservers. By SAMUEL WHITE WHITE, Great Britain. Oct. 14th.

CLAIM.—What I claim as my invention is:—1. The making of hats, caps and bonnets, with a space *a* water-proof, as above described.—2. The application of a water-proof lining, as shown at *b*, for the purpose of preventing persons sinking when in the water.

Improvement in Cooking Stoves. By JAMES PARMELE, Ogden, N. Y. Oct. 14th.

CLAIM.—What I claim as my invention, and which I desire to secure by letters patent, consists in the manner in which I have combined the damper G, with the horizontal plate P and dividing plate H, the plate P being constructed with an aperture, to which the dividing plate H and damper G are adapted, as herein set forth; the damper, when raised, dividing the space immediately under the boilers into two parts, and allowing the draft to pass under the boilers F, through that part of the aperture K′ in plate P, on one side of the damper G, and dividing plate H, and thence around the oven through the flue *k*, and the part of the aperture in the plate P, on the other side of the damper G, and dividing plate H, into the smoke-pipe T, all as herein set forth.

Improvement in the Ever-Pointed Pencil-Case. By Thos. Woodward, Brooklyn, N. Y. Oct. 14th.

Claim.—What I claim as new therein, and desire to secure by letters patent, is the employment of a bolt or catch, formed and operating substantially as herein set forth, in combination with the ordinary screw for securing the heads and points of such cases; and I also claim, in lieu of such bolt or catch at the point and tip, the combining of the cone with the ordinary screw, in the manner and for the purpose set forth, and applied to the ever-pointed pencil-case.

Improvement in Boilers for heating Water for culinary and other purposes. By Daniel L. Pickard, Hartland, N. Y. Oct. 14th.

Claim.—What I claim therein as constituting my invention, and desire to secure by letters patent, is the manner in which I have combined and arranged the respective parts, consisting of the exterior case, the furnace, the convoluted flues and water spaces, and the end water space or bulkhead, all constructed substantially as herein set forth.

LIST OF ENGLISH PATENTS

Granted between the 30th of July and the 27th August, 1840.

John Louis Bachelard, of St. Martin's Lane, gentleman, for improvements in the manufacture of beds, mattrasses, chairs, sofas, cushions, pads, and other articles of a similar nature, being a communication. July 30; six months.

Felix Troubat, of Mark-lane, merchant, for improvements in the manufacture of vinegar. August 1; six months.

William Daubney Holmes, of Lambeth-square, Surrey, civil engineer, for certain improvements in steam-engines, and in generating and applying steam as motive power. August 1; six months.

Thomas Barnabas Daft, of Birmingham, gentleman, for improvements in inkstands or inkholders. August 1; six months.

James Taaffe, of Shaw-street, Dublin, slater and builder, for improvements in roofing and slating houses and other buildings. August 1; six months.

James Hodgson, of Liverpool, engineer, for a new mode of combining and applying machinery for the purpose of cutting and planing wood, so as to produce plane or moulded surfaces. August 3; six months.

John Sanders and William Williams, of Bedford, iron-founders, and Samuel Laurence Taylor, of Old Warden, in Bedford aforesaid, machine-maker, for improvements in ploughs. August 3; six months.

George Edward Wood, of High-Holborn, engineer, for improvements in pumps, and in engines for drawing beer, cider, and other fluids. August 3; six months.

William Saunders, of China-terrace, Lambeth, chemist, for certain improvements in paving streets, roads and ways. August 3; six months.

William Beetson, of Brick-lane, Old-street, brass-founder, for improvements in water-closets, and stuffing-boxes applicable to pumps and cocks. August 5; six months.

Colin Macrae, of Cornhill, Perthshire, gentleman, for improvements in rotary engines worked by steam, smoke, gases, or heated air, and in the mode of applying such engines to useful purposes, being a communication. August 5; six months.

Theophilus Richards, of Birmingham, merchant, for certain improvements in cutting or sawing wood, being a communication. August 5; six months.

Henry Trewhitt, of Newcastle-on-Tyne, esquire, for improvements in applying the power of steam-engines to paddle-shafts used in propelling vessels, being a communication. August 7; six months

Robert Stirling Newall, of Dundee, gentleman, for improvements in wire-ropes,

and in machinery for making such ropes, being partly a communication. August 7; six months.

Andrew Smith, of Princes-street, Leicester-square, engineer, for certain improvements in carriages, wheels, rails, and chairs for railways. August 7; six months.

Thomas John Davis, of 5 Bloomsbury-square, esquire, for certain improvements in the form and combination of blocks of such materials as are now used or hereafter may be used in building, or for paving public and private roads and court-yards, or public and private causeways and subways, or any other purposes to which the said form and combination of blocks may be applied. August 8; six months.

Downes Edwards, of Surbiton-hill, Kingston, farmer, for improvements in preserving potatoes and other vegetable substances. August 8; six months.

John Isaac Hawkins, of College-place, Camden-town, civil engineer, for an improvement or improvements in buttons, and in the modes of affixing them to clothes, being a communication. August 8; six months.

Francis William Gerrish, of East-road, City-road, ironmonger, for improvements in apparatus to be used as a fire-escape, also applicable to other purposes where ladders are used. August 8; six months.

Samuel Howard, of Manchester, engineer, for certain improvements in boilers and furnaces. August 8; two months.

Baron Charles Wetterstedt, of Limehouse, for improvements in preserving vegetable, animal and other substances from ignition and decay. August 11; six months.

John Peter Isaic Poncy, of Well-street, Oxford-street, watch-dealer, for improvements in clocks and chronometers, being a communication. August 13; six months.

Miles Berry, of Chancery-lane, patent agent, for certain improvements in the arrangement, construction and mode of applying certain apparatus for propelling ships and other vessels, being a communication. August 14; six months.

Pierre Armand le Comte de Fontainemorean, of Skinners-place, Size-lane, gentleman, for certain improvements in covering and coating metals and alloys of metals. August 15; six months.

John Young, of Wolverhampton, ironmaster, for improvements in the manufacture or construction of knobs, handles, frames, tablets, boxes, and other ornamental articles applicable to the decoration of houses and domestic furniture. August 17; six months.

Luke Hebert, of Birmingham, civil engineer, for certain improvements in the manufacture of needles. August 17; six months.

Joseph Lockett, of Manchester, engineer, for certain improvements in manufacturing, preparing and engraving cylinders, rollers, or other surfaces for printing or embossing calicoes or other fabrics. August 27; six months.

Charles Smith, of Exeter, builder, for improvements in the manufacture of lime and cements or composition. August 27; six months.

William Church, of Birmingham, civil engineer, for improvements in fastenings applicable to wearing apparel, and in apparatus for making the same and like articles, and also in the method or methods of preparing the said articles for sale. Aug. 27; six months.

Hugh Unsworth, of Blackwood, Lancaster, bleacher, for certain improvements in machinery or apparatus for mangling, drying, damping and finishing woven goods or fabrics. August 27; six months.

Thomas Robinson Williams, of Cheapside, gentleman, for certain improvements in measuring the velocities with which ships or other vessels or bodies move in fluids, and also for ascertaining the velocities of fluids in motion. August 27; six months.

Benjamin Hick, jun. of Bolton-le-Moors, Lancaster, engineer, for certain improvements in regulators or governors, in regulating or adjusting the speed or rotary motion of steam-engines, water-wheels, and other machinery. August 27; six months.

Henry Waterton, of Fulmer-place, Gerard's-cross, Buckingham, esquire, for improvements in the manufacture of sal-ammoniac. August 27; six months.

List of Scotch Patents granted between the 22d July and 21st August.

Christopher Nickels, of the York-road, Lambeth, Surrey, gentleman, for improvements in the manufacture of braids and plats. Sealed July 23. A communication.

William Palmer, of Sutton-street, Clerkenwell, Middlesex, candle-maker, for improvements in the manufacture of candles, and in apparatus for applying "light." July 23.

Daniel Gooch, of Paddington Green, Middlesex, engineer, for improvements in wheels and locomotive engines to be used on railways. July 24.

Henry Dircks, of Liverpool, Lancaster, engineer, for certain improvements in the construction of locomotive steam-engines, and in wheels to be used on rail and other ways, parts of which improvements are applicable to steam-engines generally. July 24.

Joseph Tunnicliff, of Charles-street, in the City Road, Middlesex, engineer, for certain improvements in the machinery or process for the reduction or comminution of dye-woods, for facilitating the extraction of their "coloring matter." July 27.

Renewal of patent to John George Bodmer, of Manchester, Lancaster, engineer, for the term of seven years, from the 18th of August, 1824, granted to him for certain improvements in the machinery for cleaning, carding, drawing, roving aad spinning of cotton and wool. July 27.

Richard Smith and Richard Hacking, both of Bury, Lancaster, machine makers, for certain improvements in machinery for spinning cotton and other fibrous substances. July 28.

Richard Smith and Richard Hacking, both of Bury, Lancaster, machine makers, for certain improvements in machinery or apparatus for drawing, slubbing, roving, and spinning cotton, wool, flax, silk and other fibrous substances. July 31.

John Aitchison, of Glasgow, in Scotland, at present residing at 144 Minories, in the city of London, merchant, and Archibald Hastie, of West-street, Finsbury-square, Middlesex, merchant, for certain improvements in generating and condensing heating, cooling and evaporating fluids. July 31.

Richard Beard, of Egremont-place, New Road, Middlesex, gentleman, for improvements in apparatus for obtaining likenesses and representations of nature, and of drawings, and other objects. August 4. A communication.

Richard Hodson, of Salisbury-street, Strand, Middlesex, gentleman, for improvements in the forms or shapes of materials and substances used for building and paving, and in their combinations for such purposes. August 4. A communication.

John Rapson, of Park-street, Park-place, Limehouse, Middlesex, engineer, for improvements in steering ships and vessels. August 4.

Thomas Oram, of Lewisham, Kent, gentleman, for improvements in the manufacture of fuel. August 4.

Samuel Lawson, of Leeds, York, and John Lawson of the same place, engineers, and co-partners, for improvements in machinery for spinning, doubling, and twisting flax, hemp, wool, silk, cotton, and other fibrous substances. August 6. A communication.

George Clarke, of Manchester, Lancaster, manufacturer, for certain improvements in the construction of looms for weaving. August 6.

Robert Hampson, of Mayfield Print Works, Manchester, Lancaster, calico printer, for an improved method of block printing on woven fabrics of cotton, linen, silk, or woolen, or of any two or more of them intermixed, with improved machinery, apparatus and implements for that purpose. August 13.

Colin Macrae, of Cornhill, Perthshire, Scotland, gentleman, for improvements in rotary engines, worked by steam, smoke, gases or heated air, and in the mode of applying such engines to useful purposes. August 13. A communication.

Downes Edwards, Surbiton Hill, Kingston, Surrey, farmer, for improvements in preserving potatoes and other vegetable substances. August 13.

William Crane Wilkins and Matthew Samuel Kenrick, of Long Acre, Middlesex, lamp manufacturers, for certain improvements in lighting and in lamps. August 13.

Charles Wheatstone, of Conduit-street, Hanover Square, Middlesex, esquire, and William Fothergill Cooke, of Copthall Buildings, in the city of London, esquire, for improvements in giving signals and sounding alarms at distant places, by means of electric currents. August 21.

List of Irish Patents, granted for July, 1840.

J. H. Young, for an improved mode of setting up printing types.

Orlando Jones, for improvements in treating or operating on farinaceous matters, to obtain starch and other products, and in manufacturing starch.

F. G. Spilsbury, M. F. C. D. Corbaux. and A. S. Byrne, for improvements in paints, or pigments, and vehicles, and in modes of applying paints, pigments, or vehicles.